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DIETing_LAB
Digital Lab for Education in Dietetics

Preliminary Impact Analysis and lessons learned

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1. Executive Summary

The Digital Lab for Education in Dietetics project, supported by the Erasmus Plus program, aims to enhance dietetics education and community outreach by leveraging digital tools to bridge the gap between theoretical knowledge and practical skills. In a field where hands-on clinical experience can be limited, this project provides an innovative solution through its self-learning and service-learning platforms. These tools empower dietetics students and professionals by offering immersive, real-world learning experiences that are accessible, and can be tailored to diverse educational needs. Beyond its educational impact, the project promotes equitable health access by engaging communities through telehealth solutions, making dietary education and services available to those who need them most, all while fostering sustainable practices.

The project targets dietetics students, educators, and community members, with the broader goals of enhancing practical skills, interpersonal competencies, promoting social responsibility in the field of dietetics education.

Two core results of the project are the self-learning tool and service learning/trainer's tool. The self-learning tool features a virtual patient chatbot platform that allows students to engage in simulated clinical interactions. It provides an interactive environment where users can practice case-based scenarios, develop critical thinking skills, and receive feedback on their decisions. The service-learning tool functions as a virtual clinic, offering a telehealth experience where students can conduct consultations with real or role-play patients. This tool facilitates experiential learning by allowing students to apply their knowledge in supervised settings, offering dietetic advice, and gaining valuable interpersonal and professional skills in a controlled yet practical environment. Together, these tools bridge the gap between classroom learning and real-world practice, ensuring that students are better prepared for their future careers.

The project's pilot phase, spanning from September 2023 to July 2024, involved extensive testing and feedback collection across partner institutions in Europe. The self-learning tool was piloted with over 700 users, while the service-learning virtual clinic engaged nearly 180 users in simulated and real dietetic consultations. The piloting activities, though varied in structure due to differing educational frameworks and course schedules, provided valuable insights into the effectiveness, challenges, and areas for improvement of these tools.

Self-learning tool- Key Findings and lessons learned

1. **Broad Accessibility and Engagement:** With over 700 users participating in the piloting phase, the Self-Learning Tool successfully engaged students, educators, and dietitians across our European sites. The platform's availability in multiple languages, including Spanish, Portuguese, Polish, Dutch German and English ensured that participants from diverse educational settings could engage with the tool in their preferred language. This multilingual capability is essential for fostering an inclusive learning environment, enabling the tool to be integrated across different curricula.

2. **Useful tool for Beginners**: The Self-Learning Tool was perceived as particularly beneficial for students early in their dietetic education , providing structured practice in basic dietary consultations and patient history-taking. However, this also means interactions with the virtual patient can be challenging as students are less practiced in standard assessment techniques. This challenge mirrors the experience of real-life consultations, where students must learn to ask precise, relevant questions. The tool's design encourages this learning process, helping students refine their questioning techniques in a low-risk environment.
3. **Engagement with Technology**: Survey results showed significant increases in students' familiarity with chatbots and their skills in using them for dietetic learning, indicating the tool's effectiveness in introducing and acclimatizing users to digital solutions in healthcare, making it an asset in modernizing dietetics education.
4. **Mixed perceived benefits:** Over 70% respondents found the platform updated their practical knowledge, improved classroom practice, increased interpersonal and coaching skills, increase awareness of harmonisation of dietetic care process in Europe. However, there was small reduction in perceived benefits of the chatbot to practical skills, job preparedness and innovation which warrants further investigation and improvements.
5. **Increased expectations of AI capabilities:** Many users may be now familiar with the generative AI chatbots such as OpenAI's ChatGPT, which may have increased expectations in terms of conversational capabilities of the chatbot. In the future, integration of more recent advanced AI models will enable the chatbot to handle more complex and emotionally nuanced interactions, making the learning experience more realistic and valuable for students.
6. **Improvements to self-evaluation**: While use of the International Dietetics Nutrition Terminology (IDNT) was useful as a first step in the self-evaluation component of the tool. Future iterations may benefit from context-specific, case-based questions that are independent of the diverse dietetic terminologies used across partner institutions, additionally provision of information about the cases the virtual patients are based on in 4.2 will allow sites to develop their own tailored evaluations for students as required.
7. **Technical Limitations**: Addressing browser compatibility issues, optimizing the user interface, and providing comprehensive user guides will enhance the overall experience and ease of integration into classrooms.
8. **Structured Integration and Support**: Providing structured guidance on how to incorporate the tool into existing curricula, along with clear documentation and resources for instructors, will ensure consistent and effective use across diverse educational settings. This will be developed and provided in reports 4.2 and 4.4 of the multiplier toolkit.
9. **Further research on user engagement:** for the registered users who did not compete an interaction with the chatbot, It would be useful in future to re-engage these users or further investigate reasons for non-completion of the cases.

Service-Learning Tool- Key findings and lessons learned

1. **Real-World Application in Community Outreach:** A subset of piloting activities integrated the service-learning virtual clinic into community outreach programs. Students used the platform to provide general dietary advice to real patients, offering a valuable service while honing their consultation skills. The telehealth format enabled students to reach populations that face barriers to accessing healthcare, such as those in remote regions. By offering consultations online, the platform extends the reach of dietetic care to underserved communities, supporting equitable access to health services.
2. **Enhancing community health:** Successful community engagement activities led to over 70% of surveyed community participants reporting increased awareness of healthy habits and ability to start a new healthy habit after their interaction with dietetic students.
3. **Accessibility:** the online nature of the tool was well received by participants and demonstrated its use in reducing the need for travel, supporting distance and online learning and community outreach activities.
4. **Flexibility in classroom integration**: The Service-Learning Tool's versatility has allowed partner institutions to incorporate it into different educational frameworks. Some universities used the platform for role-playing scenarios, enabling students to practice interpersonal skills and consultation techniques, while others integrated it into dietetic internships, allowing students to provide real-time advice to community members under supervision. Future deployments should focus on developing comprehensive, adaptable guidelines for integrating the platform into diverse curricula based on successful piloting scenarios, to be provided in reports 4.2 and 4.4 of the multiplier toolkit.
5. **Communicate unique benefits:** : The platform's telehealth focus was recognized as valuable, but there was not a clear point of differentiation from existing telehealth services limiting its perceived innovation. Highlighting the platform's unique capabilities, such as generating new chatbot data from patient interviews, could improve user engagement and satisfaction.
1. **Provide Data Security information**: While the platform is hosted on a secure platform, there were still some concerns around data security, particularly for activities involving members of the public. Addressing any concerns around patient data security is critical for broader adoption. Clear guidelines, compliance measures, and legal assurances should be clearly documented to build trust among users and institutions in report 4.2 of the multiplier toolkit, based on the technical report found in this report.
2. **User Interface and Technical Optimisation**: The technical performance was overall very good. Some improvements to scheduling processes, notifications, and addressing delays in video session management should be prioritized. Additionally, introducing features like screen sharing and file uploads for patients could enhance the platform's usability in real-world telehealth scenarios.

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2. Introduction

The Digital Lab for Education in Dietetics (E+Dieting_Lab) project, supported by the Erasmus Plus program and the Spanish Service for the Internationalisation of Education (SEPIE), is a pioneering initiative aimed at bridging significant gaps in dietetic education through the integration of innovative digital tools. This report focuses on the technical development and analysis of piloting activities of the Digital Lab for Education in Dietetics Self-Learning Tool and Service-Learning and Trainer's Tool.

This report outlines the key preliminary results and lessons learned from the piloting activities conducted up to July 2024. The E+Dieting_Lab project has been designed to enhance practical skills, interpersonal abilities, and digital competencies of dietetics students. Through the use of virtual patients and interactive clinical environments, the project aims to provide students with immersive and realistic learning experiences that simulate and foster real-world clinical interactions. These innovative educational strategies are intended to prepare students for effective professional practice, addressing the increasing global health challenges related to diet and nutrition.

The pilot program included testing with all targeted user groups and data collection through pre- and post-surveys, along with feedback from project partners across Europe. This report will explore data collected, analysing both quantitative and qualitative feedback to identify successes, challenges, and areas for improvement. Additionally, it will provide initial insights into the applicability of these tools within the dietetic curriculum and offer recommendations for future enhancements.

As we move forward, the findings from this preliminary analysis will inform the ongoing development and refinement of the E+Dieting_Lab tools, ensuring they meet the educational needs of dietetics students and align with the evolving demands of healthcare systems. This report serves as a crucial step in our commitment to transforming dietetics education and improving health outcomes through innovative, technology-driven learning solutions.

Section 2 outlines the background of the E+Dieting_Lab project and provides a summary of the project's main deliverables and piloting activities. Section 3 and 4 details the development, technical specifications, piloting activities and feedback of the self-learning and service-learning tools respectively.

2.1 Background and Rationale to the E+Dieting_Lab Project

The E+Dieting_Lab project aims to support dietetic education by implementing innovative digital solutions that develop practical skills, interpersonal and coaching skills and digital competencies of dietitians. Specifically, the project has developed two digital tools, namely a set of virtual patient chatbots for experiential learning and a virtual clinic for service learning. The project was developed in response to several critical needs in dietetics education and the broader healthcare context: addressing global health challenges, enhancing access to practical dietetics education, enhancing interpersonal and coaching skills of dietitians, promoting social responsibility, aligning health systems and policy makers towards human nutrition, and responding to advances in technology through innovation in education.

Addressing Global Health Challenges

The rise in diet-related health issues such as obesity, diabetes, cardiovascular diseases, and other non-communicable diseases (NCDs) presents a significant challenge globally. These conditions are largely preventable through appropriate dietary and lifestyle interventions. However, the effectiveness of such interventions depends heavily on the skills and competencies of dietitians. The E+Dieting_Lab project aims to enhance the practical skills of dietitians, enabling them to provide effective nutritional counselling and interventions that can help mitigate these health issues.

Access to Practical Dietetics Education

Traditional dietetics education often lacks sufficient clinical practical training opportunities to optimally prepare students for the workforce with an average of 12 weeks of clinical placements for students across Europe [1], [2]. Students frequently graduate with substantial theoretical knowledge but limited hands-on experience. For example a report from the National association of nutrition students in portugal (Associação Nacional de Estudantes de Nutrição) found that From a sample of 238 students from the 1st to the 4th year of the Bachelor's Degree in Nutrition Sciences and the Bachelor's Degree in Dietetics and Nutrition in Portugal, the majority (54.6%) considered that contact with practical reality throughout the course was insufficient. This perception is even more noticeable among final-year students: a total of 73 per cent of students believe that their training needs more contact with professional reality [3].

This gap between theoretical knowledge and hand on experience may hinder students ability to perform effectively in real-world clinical settings. The E+Dieting_Lab project aims to address this gap by providing innovative digital tools that simulate patient interactions to aid in student preparation as well as provide a virtual platform for supervised real-world practice to allow for more flexibility and access for students to clinical patient interactions. These tools allow students to practice and refine their skills in a controlled, virtual environment, thereby enhancing their readiness for professional practice.

Enhancing Interpersonal and Coaching Skills

Effective dietetic practice requires strong interpersonal and coaching skills, in fact communication, relationship and partnership skills is the 6th Domain of dietetic competency of the European Federation of the Association of Dietitians (EFAD) [4]. Dietitians must be able to build rapport with clients, communicate effectively, and provide motivation and support for behaviour change. The E+Dieting_Lab project incorporates service-learning and experiential learning strategies to enhance traditional education method and build these essential skills, ensuring that future dietitians can engage clients effectively and foster positive health outcomes.

Promoting Social Responsibility
Universities have a social responsibility to contribute to the health and well-being of their communities. The E+Dieting_Lab project promotes this by providing a platform where students can engage in community service-learning activities related to nutrition and healthy living. This not only enhances students' practical skills but also instils a sense of social responsibility and commitment to public health.

Aligning Health Systems and Policy Makers towards Human Nutrition
Preventative health policy is an important component of public health and the integration of nutritional therapy in the management of chronic diseases is essential to this. There is a growing need for dietitians who are well-versed in these areas and can collaborate effectively with other healthcare professionals and policymakers. The E+Dieting_Lab project aligns dietetics education with these evolving healthcare needs, ensuring that graduates are prepared to contribute to and lead in multidisciplinary healthcare teams.

Technological Advancements and Innovation in Education
The rapid advancement of technology offers new possibilities for enhancing education. The E+Dieting_Lab project leverages these advancements by integrating artificial intelligence and digital tools into dietetics education. This not only makes learning more engaging and interactive but also ensures that students are proficient in using modern technologies that are increasingly prevalent in healthcare settings.

The E+Dieting_Lab project is a forward-thinking initiative designed to address these critical needs in dietetics education and healthcare. By enhancing practical skills, interpersonal abilities, and digital competencies, the project prepares future dietitians to effectively tackle global health challenges, promote public health, and lead in an evolving healthcare landscape. Through innovative digital solutions and a commitment to social responsibility, the E+Dieting_Lab project aims to transform dietetics education and improve health outcomes worldwide.

2.1.1 Project Participants

The E+Dieting_Lab project involves a consortium of academic and professional institutions across Europe, each contributing unique expertise to the initiative:

1. **Fundación Universidad Europea del Atlántico (UNEAT)** - Leading the project with significant experience in human nutrition and dietetics education, Information and Communication Technologies applyed to education and training. The organization developed a modern infrastructure for e-learning, and developed several research projects related to ICT, learning technologies including Artificial Intelligence.
2. **Universidad de Valladolid (UvA)** - Spain: One of Spain's leading higher education institutions, recognized for its robust research capabilities with 190 prestigious research groups and a strong emphasis on interuniversity collaboration. UVA has actively participated in over 100 European projects, including Erasmus+, LIFE, and INTERREG initiatives, showcasing its strategic international partnerships. The university excels in innovation and knowledge transfer, managing 180 annual R&D projects and 350 industry collaborations, and driving advancements in fields like eHealth through its Telemedicine and eHealth Group (GTe).
3. **Fachhochschule St. Pölten (STP)** - Austria: A forward-thinking institution that combines strong regional engagement with a global perspective. It boasts diverse expertise across six departments and research institutes, driving innovation in fields such as digital technologies, health sciences, and mobility. The university is recognized for its teaching methods, including interdisciplinary labs, dual

study programs, and international project opportunities. St. Pölten UAS also champions entrepreneurship and regional innovation through initiatives like the "7 Steps to Start-Up" program and its leadership role in Austrian Digital Innovation Hubs.

4. **Universidade do Porto (UP)** - Portugal: Fosters a dynamic academic environment across 14 faculties, a business school, and 49 research units, focusing on employability, market relevance, and societal impact. The Faculty of Nutrition and Food Sciences (FCNAUP) is Portugal's only public institution offering a degree in nutrition and food sciences. With highly skilled teaching and research staff, FCNAUP excels in fields such as clinical nutrition, public health, and food sciences, contributing to research, education, and community dietary support. It is actively involved in innovative initiatives, including research projects and community courses.
5. **Artesis Plantijn Hogeschool Antwerpen (AP)** - Belgium: A dynamic institution which excels in international collaboration, participating in numerous funded projects such as Erasmus+, Creative Europe, and Interreg. The Nutrition and Dietetics program at AP is highly active in European initiatives, serving as a key contributor to EFAD and ENDietS while promoting innovation through projects like IMPECD, which developed a standardized Dietetic Care Process and a pioneering MOOC. AP also brings significant expertise in interprofessional education, fostering collaboration across disciplines for both students and professionals.
6. **Uniwersytet Jana Kochanowskiego w Kielcach (UJK)** – Poland: Jan Kochanowski University in Kielce is actively involved in international research projects. We promote interdisciplinary cooperation in the field of health and nutrition sciences. The university works with partners from different countries, combining scientific knowledge and practical approaches to the challenges of healthy eating. Through such initiatives, UJK strengthens its position on the international stage, promoting scientific development and cross-cultural exchange.

2.1.2 Project Results

The project delivers three main results to transform dietetics education through innovative digital solutions:

1. **R1: Digital Lab for Education in Dietetics (Self-Learning Tool)**:
   - **Objective**: To provide students with a self-learning platform to develop patient history taking skills.
   - **Features**: Five interactive virtual patients build on artificial intelligence based on real-life scenarios focusing on themes such as obesity, diabetes, nephropathy, and gastrointestinal disorders.
   - **Target**: Student dietitians, community dietitians
2. **R2: Digital Lab for Education in Dietetics (Service-Learning and Trainer's Tool)**:
   - **Objective**: To facilitate interactive learning experiences where learners interact with individuals in a supervised environment.
   - **Features**: A virtual clinic where students can role play or interact under supervision with real patients. Utilizes service-learning and AI for enhanced training.
   - **Target**: Student dietitians, educators, community dietitians.
3. **R3: Multiplier Toolkit**:
   - **Objective**: To disseminate the digital tools developed in the project to a broader audience.
   - **Components**: Includes reports, awareness materials, guidelines, and a syllabus to implement the digital tools in other HEIs and training centres.
   - **Target**: Higher education institutions, teachers, dietitians, policy makers

These results are designed to enhance the practical skills, interpersonal abilities, and digital competencies of dietetics students, preparing them for effective professional practice. Each of the results is available in the languages of the participant countries: Spanish, Dutch, Polish, German, Portuguese and English.

2.2 The pilot program

Both the self-learning tool and the service-learning tools have been piloted by partners during the project. In this report we reflect on the results of piloting activities from September 2023 up to the end of July 2024, though some piloting activities are ongoing.

The piloting program aimed to test each result with its intended target groups to identify areas for improvement and help inform the applicability of the tools in the dietetic education programs moving forward. During piloting data was collected from participants through pre and posttest surveys as well as additional local feedback at specific sites including qualitative and quantitative data. Overall, the self-learning tool was piloted with 707 users, 525 of whom completed the initial survey and 316 who completed the final survey (320 completing both). The service-learning virtual clinic was piloted with 177 users, 76 of whom completed the pre and post surveys.

Piloting activities varied between project partner sites due to differing availabilities of students, course timing and structure and applicability to program. The self-learning tool was generally piloted in class with support from teaching staff, though a proportion of users registered and piloted independent from structured class activities. The service-learning tool was piloted with students and community members in a variety of formats including role play and real, supervised dietetic consults.

3. Digital Lab for Education in Dietetics (Self-Learning Tool)

The digital lab is an interactive self-learning tool for student dietitians, featuring a website with registration access to five virtual patient chatbots. These chatbots facilitate practice in patient history taking and depict various medical and nutritional issues, each created by different project partners. The virtual patients are:

1. Karen Pérez – Coeliac disease
2. Lore Janssens – Type 1 diabetes
3. João Almeida – Renal disease
4. Queenie Hart – Type 2 Diabetes and cardiovascular disease
5. Maria Nowak – Obesity

Each case was developed to a standardized template, providing information on medical history, family history, social history, biochemical results, clinical symptoms and diet history. This information was then transformed to an AI supported chatbot using the Dialogflow platform. It is important to note that the chatbots use natural language processing to interpret user requests, but all responses are hardcoded. Additionally, to provide a self-learning effect evaluation questions about each case were developed and integrated into the platform as well feedback on the number of questions a user asked the patient in comparison to the amount of information available. All cases were translated into each of the represented partners countries languages: Spanish, Dutch, European Portuguese, Polish, German and English.

When the user registers with the site, they can select one of the patients to interact with. Following, the user can ask the virtual patient questions, as they would in a dietetic consultation, to ascertain the patient's history. Additionally, the user can conduct a 24-hour diet recall as well as additional dietary information on frequencies of certain foods. Once the user is satisfied that they have all necessary information they can end the interview and complete a self-evaluation by answering questions about the case relating to the International Dietetics Nutrition Terminology (IDNT). The user will then be shown whether they answered the questions correctly and additionally given feedback on the completeness of their interview. The user may also download a copy of the interaction with the patient. A more detailed guide on using the self-learning tool including user manual and lesson plans will be given in Report 2 of the Multiplier Toolkit: Report on Recommendations for Dietetics Education Addressed to Trainers and Managing Boards.

The goal of this self-learning tool is to develop students' skills is taking a patient history to better prepare them for interactions with real patients. Specific classroom implementations, learning outcomes and syllabus integration will be detailed in Report 2 and 4 of the multiplier toolkit. Additional applications for dietitians outside of education will be detailed in report 3.

3.1 Technical Description of self-learning tool

The self-learning tool is a web-based application that allows users to interact with virtual patients through a chatbot interface powered by Dialogflow. The tool aims to help students and dietitians practice their patient history taking skills and receive feedback on their performance. The tool also provides evaluation questions based on the International Dietetics Nutrition Terminology (IDNT)[5] and allows users to download a transcript of their conversation with the virtual patient.

Interfaces

Website: The website is the main entry point for the users to access the self-learning tool. The website is hosted at: https://virtual-patient.edietinglab.eu/. The website allows users to register and log in with their email and password. The website also provides information about the project, the partners and the virtual patients. The self-evaluation component of the tool is also generated within the website. It is available in six languages: English, Spanish, Dutch, Portuguese, Polish, and German.

Chatbot: The chatbot interface is the core component of the self-learning tool. It allows users to select a virtual patient and start a conversation with them. The chatbot interface is embedded in the website and communicates with the Dialogflow platform using Botcopy. The chatbot interface supports text and voice input and textual output in six languages.

Dialogflow: The Dialogflow platform is a cloud-based service that provides natural language understanding and conversational capabilities for the chatbot interface. The Dialogflow platform is responsible for processing the user input, matching it with the appropriate intents and entities, and generating the corresponding responses from the virtual patient. The Dialogflow platform also handles the logic and flow of the conversation, as well as the integration of external services such as speech recognition and synthesis. The Dialogflow platform contains five agents, one for each virtual patient. Figure 1 highlights the main software interfaces of the solution.

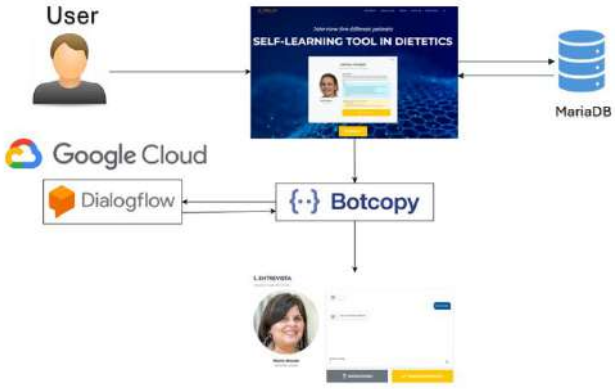

Figure 1: Visualisation of software interfaces for the self-learning tool

Software and third-party services

- **Website:** was developed without using specific frameworks. On the server side, PHP is used along with MariaDB for database management. The APIs, which facilitate communication through JSON, are designed to handle users, surveys, and data derived from user interactions.
- **Dialogflow Essentials:** is the primary software framework used for developing the chatbot. It provides a comprehensive platform for creating, training, and deploying conversational agents based on natural language.
- **Botcopy:** acts as a complementary software framework used for integrating the chatbot with the web interface, enabling a smooth and enriched user experience.
- **Google Cloud Platform (GCP):** provides the underlying infrastructure to host and run the chatbot. It utilizes various GCP services, such as Google Cloud Functions for serverless logic and Google Cloud Storage for data storage.

Google Cloud Storage: To store data and additional files necessary for the chatbot interactions.

Software interactions

1. **User interacts with the Website**:
    - The user visits the website (registers or logs in) and uses the integrated chatbot.
2. **The Website contains the Botcopy widget, which enables communication with Dialogflow**:
    - The website has the Botcopy widget integrated. This widget facilitates the chatbot interface that the user sees and interacts with.
3. **Botcopy acts as an intermediary, sending user inputs to Dialogflow**:
    - When the user types a message or question into the chatbot, Botcopy takes this message and sends it to the Dialogflow platform.
4. **Dialogflow processes the inputs, identifies the intents, and formulates responses**:
    - Dialogflow receives the message sent by Botcopy. It uses its natural language processing (NLP) capabilities to analyse the message, identify the user's intent, and formulate an appropriate response based on its training and available data.
5. **Dialogflow sends the processed response back to Botcopy**:
    - Once Dialogflow has generated a response, it is sent back to Botcopy. Botcopy then displays this response to the user in the chatbot interface within the website.

Licenses

DialogFlow Essentials is a service offered by Google Cloud Platform. The use of DialogFlow is subject to the Google Cloud Platform Terms of Service and Google's Privacy Policy. DialogFlow offers a free tier with certain limitations, as well as pay-as-you-go options for greater scalability and advanced features.

Botcopy is a service offered as Software as a Service (SaaS). The use of Botcopy is subject to the terms outlined in its Terms of Service and Privacy Policy.

Infrastructure and Hosting

The chatbot is hosted on the Google Cloud platform, utilizing the services of Dialogflow Essentials. The chatbot's interface is integrated into a webpage using Botcopy.

Dialogflow Essentials, being a Google Cloud platform, means that the chatbot's backend services, including natural language processing (NLP), intent handling, entities, and contexts, are hosted and managed by Google Cloud's infrastructure.

Botcopy is a SaaS platform that integrates with Dialogflow and is hosted on its own cloud infrastructure. The integration with Dialogflow is done via APIs, and Botcopy manages the presentation and interface of the chatbot on the webpage.

The webpage containing the chatbot is hosted on https://virtual-patient.edietinglab.eu/, ensuring seamless integration and optimal performance for end users. This hosting platform provides reliable uptime, security features, and scalable resources to support the chatbot's web interface.

Server Specifications

Google Cloud Server:

- **Operating System:** The chatbot on Google Cloud uses Linux-based operating systems to ensure stability and security.
- **Capacity:** Google Cloud's infrastructure is highly scalable, allowing dynamic adjustment of computing and storage resources according to the chatbot's demand. Allocated resources include virtual CPUs and SSD storage for optimal performance.
- **Location:** The Google Cloud servers used to host the chatbot are located in data centres globally distributed, with specific options for regions including the United States, Europe, and Asia, providing low latency and high availability.

Botcopy Server:

- **Operating System:** Botcopy uses Linux-based servers for its infrastructure.
- **Capacity:** As a SaaS platform, Botcopy automatically scales its resources to handle the load of users and requests to the chatbot.
- **Location:** Botcopy hosts its services in secure and redundant data centres, strategically located to ensure fast and reliable access globally.

Website Server:

- **Operating System:** Utilizes servers based on Debian 11.
- **Capacity:** The website is hosted on servers equipped with 2 Intel Xeon CPUs at 2.20 GHz, 4 GB RAM, and 50 GB of standard disk storage to ensure optimal performance and fast loading times.
- **Location:** The servers are located in data centres managed by Google Cloud, which ensures low latency for users in the target region.

Data Storage

- **Data on Google Cloud:** Dialogflow handles the storage of data related to user interactions, including user messages, detected intents, identified entities, and conversation contexts. The data is securely stored on the Google Cloud Platform (GCP) infrastructure, specifically in Google-managed storage services.
- **Integration with the Website:** Botcopy facilitates the integration of the chatbot with the website, ensuring that interaction data is transmitted and stored securely on Google Cloud.
- **Data Storage on the Website:** The website where the chatbot is integrated uses a MariaDB database to store user information and interaction logs. This information is stored and managed in the backend of the web application.

Security Measures

Data Encryption

Encryption of Connection (SSL/TLS): DialogFlow Essentials uses SSL/TLS to encrypt communication between the client (such as the website where the chatbot is integrated) and Google Cloud servers hosting the chatbot. This ensures that information transmitted between the user and the chatbot is protected while traveling over the Internet.

Encryption of Data at Rest: Google Cloud Platform provides options to encrypt data stored in its services, including data used by DialogFlow Essentials. This ensures that data stored in the chatbot's database is protected even if physical access to the servers is obtained.

Compliance Standards

Dialogflow Essentials, as part of Google Cloud, benefits from Google's robust compliance and security framework. The standards and regulations it adheres to include:

- **GDPR (General Data Protection Regulation)**: A European Union regulation protecting EU citizens' privacy and personal data. Google Cloud, and thus Dialogflow Essentials, complies with GDPR requirements, including obtaining explicit consent for data collection, ensuring user rights to access and delete data, and notifying security breaches.
- **CCPA (California Consumer Privacy Act)**: A California data privacy law giving residents control over their personal information collected by businesses. Google Cloud adheres to CCPA, providing data collection and usage transparency, and allowing users to opt-out of data sales.
- **HIPAA (Health Insurance Portability and Accountability Act)**: A U.S. law setting standards for protecting medical and health information. Google Cloud offers services configurable to comply with HIPAA, ensuring the confidentiality and integrity of protected health information (PHI).
- **ISO/IEC 27001**: An international information security management standard. Google Cloud is ISO/IEC 27001 certified, ensuring adherence to best practices in information security management.
- **SOC 1/2/3 (System and Organization Controls)**: Reports providing information on internal security controls related to security, availability, processing integrity, confidentiality, and privacy. Google Cloud complies with SOC 1, SOC 2, and SOC 3, ensuring transparency and trust in its security controls.

Technical Support and Maintenance

Support Structure

- For minor technical issues related to the chatbot's functionality, a technical support team will respond via emails or direct messages on the website.
- For extremely complex problems or system errors, the issue is escalated to the development team that worked on the chatbot's implementation, who may require direct access to the source code and underlying infrastructure.

Maintenance Plan

- There will be continued communication between the nutritionist partners and the technical team. Updates will be shared over internal project communication platform, feedback from the chatbot pilot will be collected, and improvements will be discussed based on the end-user experience.

Update Policy

- Regular updates according to the release of new versions and features of DialogFlow and Botcopy.
- Based on the feedback collected from partners, regular updates and improvements will be scheduled and deployed on the chatbot to adapt it to the changing needs of users and emerging new technologies.

3.2 Piloting Activities for self-learning tool

The self-learning tool was launched in September 2023 and has been continuously piloted since. While there was an initial piloting strategy developed common to all partners, during the piloting phase partners developed their own piloting procedures due to differing course structures, semester plans and student access.

Piloting activities included:

Testing in a variety of practical and theoretical classes for nutrition and dietetic students

- Group sessions with students outside of scheduled classes
- Invitations for students and alumni/working dietitians to participate at home via email, social media campaigns, conferences
- Student projects

Testing with dietetic teachers/staff members

Data collection

The common method of data collection during piloting are the pre and post survey built into the self-learning tool platform and completed by users prior to and after interacting with a virtual patient. The questions can be found in Appendix 1. Additionally, partners collected feedback from users formally and informally through questionnaire, discussion and observation which was documented during preparations for this report (Appendix 2). Feedback was also gathered from the technical development team for specific information on technical problems and solutions encountered during piloting.

3.3 Results of Piloting the self-learning tool

As of 09.07.2024 there have been 707 registrations on the virtual patient platform. Of these 525 users have completed the initial survey pre-interacting with a chatbot and 346 have completed the final survey post chatbot interaction. Figure 2 highlights the users by group, 468 are students, 114 are dietitians, 36 are teachers and 89 are other community members.

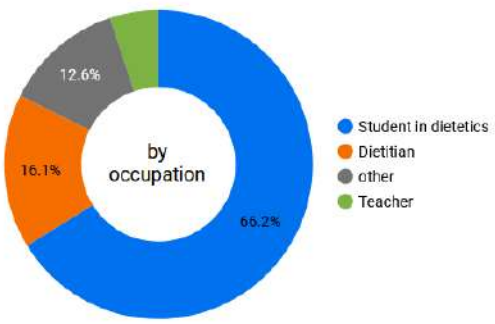

Figure 2: Users of chatbot

It is unclear why 182 of registered users have not completed an interaction with the virtual patient. It may be that this represents users who were recruited through online campaigns and thus had less instruction on what to do with the chatbot, or users who had an interest but simply did not have the time/motivation to engage with the service. It would be useful in future to re-engage these users or further investigate reasons for non-completion.

On average users discovered 20% of the available information through interacting with the virtual patient. This means that of the total amount of unique core data points available only a small amount of the information was gathered by most users. This could represent limited time with the chatbot, limited experience, unclear instructions or other factors. Within subcategories of questions users discovered on average 23% of introductory information like name, age, reason for visit etc., 32% of anthropometric data like height and weight, 14% of medical history, 13% of the diet history, 14% of food frequency type data, an example of discovered questions for a user is seen in figure 3

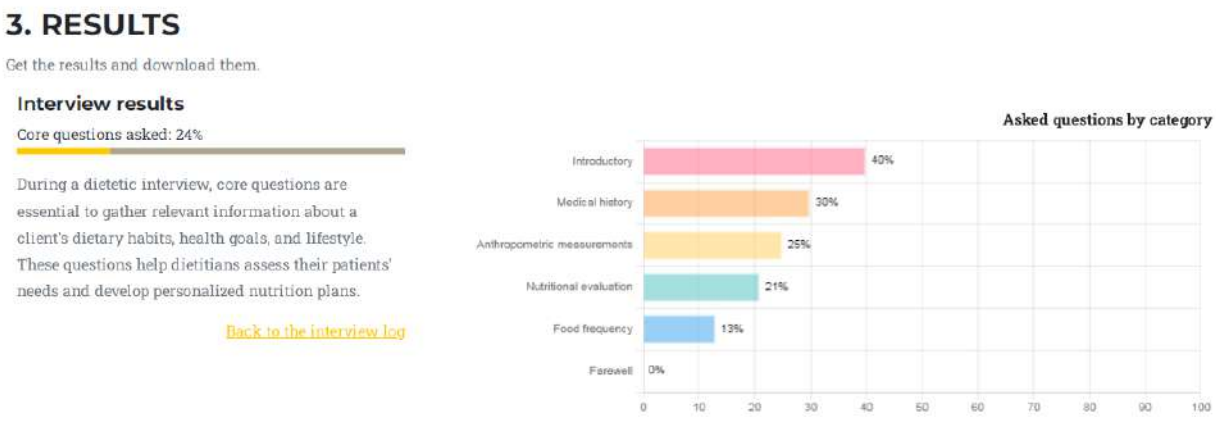

Figure 3: Example of individual feedback on percentage of core questions discovered.

Users also receive feedback on the correctness of their responses to the self-evaluation questions as based on the International Dietetic and Nutrition Terminology (IDNT), see figure 4. During piloting, assessment of the student answers was not performed as there was variation in how the tool was piloted and whether students focused on completion of this section. Given there was limited data collected on the virtual patients by the majority of users this would also make assessment difficult. Additionally, while the IDNT was originally selected for the self-evaluation as a freely available, generalisable terminology, most of the partner institutions do not teach students the IDNT terminology, instead using NCPT or ICF terminology or other local types of assessment, so the terms may have been unfamiliar to students. Therefore, optimisation and modification of the self-evaluation component may be a point of improvement for future iterations of the platform.

Figure 4: Example of self-assessment results

3.3.1 Results of User Pre and Post Surveys

The E+Dieting_Lab project included a comprehensive evaluation of the R1 digital tool through pre- and post-surveys (see Appendix). The surveys aimed to assess the familiarity, skills, expectations, and perceived effectiveness of using a chatbot as a self-learning tool among dietetics students and other users. Table 1 provides a detailed summary of the key findings based on the survey data collected from participants. Changes in mean Likert items were statistically analysed using a paired t-test or a Wilcoxon signed rank test and differences in proportions for binomial answers were tested with a 2-sample proportion test.

Participants

In total 525 users completed the pre-survey and 346 completed the post-survey of these 2 groups 320 participants completed both surveys and are included in this analysis. The users were comprised of 239 students, 33 teachers, 15 dietitians and 33 other/community members from all partner institutions. Reflecting the gender disparity in dietetics enrolments in general, 23% of respondents were male and 77% female. Figure 5 displays the language that participants used to interact with the virtual patients. Note that some universities piloted in English language classes rather than native language.

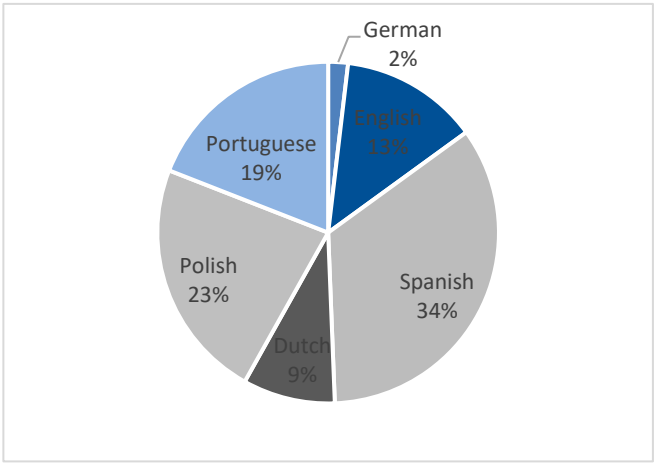

Figure 5: Language use with virtual patient

Table 1: Results of pre and post survey on the Self-learning tool

Question	Pre-survey	Post-survey	Change
Q1: Have you ever used a chatbot?	Yes: 133 (42%)	195 (61%)	+19.0% **p<0.001**
Q2. My knowledge about the use of a chatbot in the learning process by dietetics students is at (1-5: very bad – very good)	2.2	2.6	+0.4 **p<0.001**
*Q3. **My** skills in using a chatbot in the learning process as a dietetics student are at (1-5: very bad – very good)*	2.3	2.7	+0.5 **p<0.001**
Q4. Please evaluate your knowledge and skills on how to use a chatbot as a complement – self-learning tool in your learning process. (1-5: very bad – very good)	2.6	2.9	+0.3 **p<0.001**
Q5. What do you expect from using a chatbot as a self-learning tool by dietetics students?			
5A: to improve skills needed in a practical dietetic care process	266 (83.1%)	254 (79.4%)	-3.7% p=0.224
5B: to be better prepared for a future job as a dietician	222 (69.4%)	189 (59.1%)	-10.3% **p=0.007**
5C: to increase self-learning skills	223 (69.7%)	207 (64.7%)	-5.0% p=0.178 -9.7% **p=0.012**
5D: to learn in an innovative way	212 (66.3%)	181 (56.6%)	+5.9% **p=0.003**
5E: other	13 (4.1%)	32 (10.0%)	
Q6. What is your opinion about the effectiveness of using a chatbot as a self-learning tool for dietetics students? (1-5: not at all effective – highly effective)	3.6	3.4	-0.1 p=0.986
Q7. Evaluate the usefulness of using a chatbot as a self-learning tool by dietetics students to increase competence in diagnosis and work with a patient. (1-5: not at all useful – very useful)	3.5	3.4	-0.1 p=0.957
Q9. Practical knowledge associated with clinical or communication dietetics is updated (Selected/not selected)	-	245 (76.6%)	-
Q10. New training tools improve classroom practice in dietetics (Selected/not selected)	-	284 (88.75%)	-
Q11. My capacity related to interpersonal skills are increased (Selected/not selected)	-	230 (71.87%)	-
Q12: Has your participation increased your level of awareness related to harmonisation of DCP in Europe? (Yes/No)		Yes: 41 (73.2%) No: 3 (5.4%) N/A: 12 (21.4%)	
Q13: Has your participation improved your interpersonal skills or coaching capacity to benefit your future work or current professional practice? (Yes/No)		Yes: 45 (80.4%) No: 4 (7.1%) N/A: 7 (12.5%)	

Familiarity with Chatbots

Question 1 "*Have you ever used a chatbot?*" indicated that less than half (42%) were familiar with chatbots prior to interacting with the virtual patients in the pilot. Familiarity increased to 61% of respondents in the post survey, it is reasonable to conclude that the project was successful in introducing and acclimatizing a significant number of users to the chatbot technology. This exposure is crucial for modern dietetics education as it aligns with the increasing integration of technology in healthcare. It is unclear why less than 100% of respondents responded in the positive after interacting with the chatbot – it could be due to differing understandings of what constitutes a chatbot. For example, many users may be now familiar with the generative AI chatbots such as OpenAI's ChatGPT and may associate chatbot with that kind of platform rather than the type implemented in this project. However, it could also indicate that some participants were not completing the questionnaire seriously and simply clicked through.

Knowledge and Skills in Using Chatbots

Questions 2, 3 and 4 related to the expectation and the assessment of whether or not there was improved knowledge and skills of using chatbots as part of a learning process. There was a slight but statistically significant improvement between the pre and post survey with a mean score on the 5-point Likert item of knowledge (q2) increasing from 2.2 to 2.6, for skills (q3) increasing from 2.3 to 2.7 and the self-evaluation (q3) from 2.6 to 2.9. While the increase suggests improvement the scores are still sitting between a 2 and 3 on the Likert item indicating there is room for improvement. In future roll outs of the self-learning tool it will be important to support of users perhaps through more structured classroom activities that integrate the self-learning platform. Additional resources such as background information on chatbots and their applicability to healthcare/dietetics could provide useful supporting material.

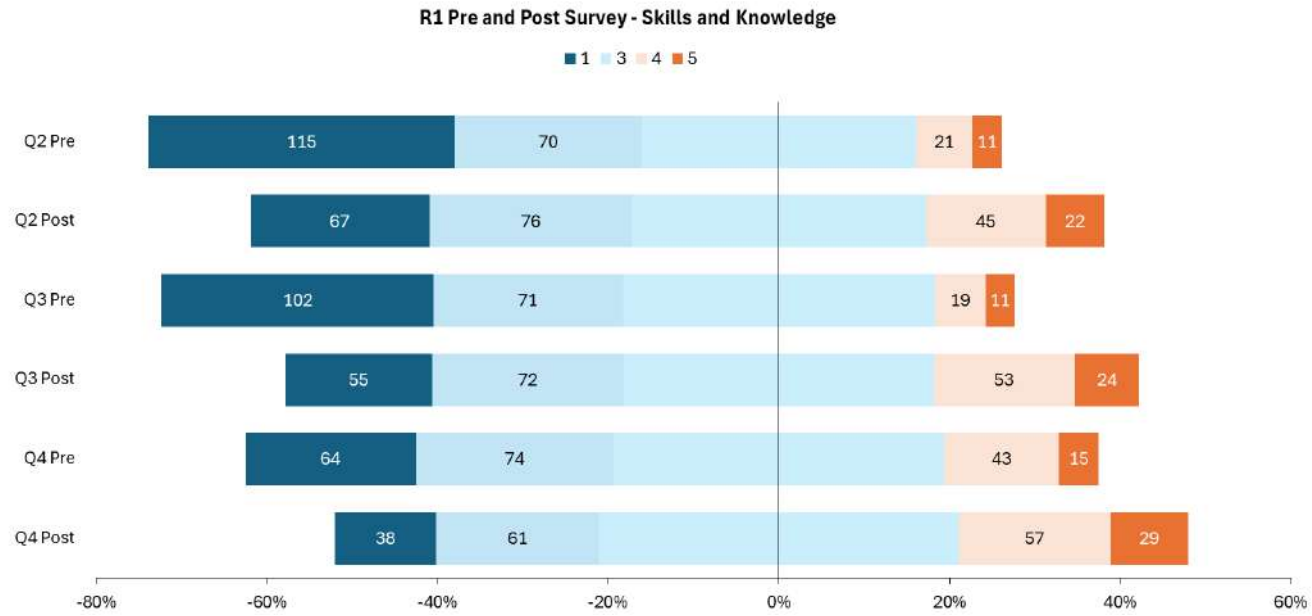

Figure 6: Self-learning platform Pre and post Survey Results Q2-4

Expectations and perceived benefits of using Chatbots.

Question 5 asked respondents about their expectations for using a chatbot. In questions 5A-D there was a decrease in the number of respondents who chose skills for practical dietetic care process, preparation for future job, increase in self-learning skills, and learning in an innovative way. The result was only statistically significant for job preparedness and innovation. These decreases after interaction with the virtual patients could be attributed to initial high expectations and the novelty of the tool wearing off over time. Additionally, with the release of generative AI models like ChatGPT, students' expectations of chatbot may have changed dramatically from when this project was first started. In terms of preparation for future jobs, as the chatbot platform currently focuses on basic skills in taking a patient history, this may be too basic to be seen to have a benefit for real work scenarios, while still being valuable for students in earlier stages of their education. Suggestions for improving these measures include, incorporating more real-world and complex case studies in the chatbots and integration of a generative AI model to expand the range of interaction that users can achieve. As illustrated in the Sankey diagrams in figure 6, it is also clear that there were a proportion of students who cross from a no to a yes and vice versa for all questions. It would be useful to investigate these subgroups more closely in future pilots or roll outs to determine why users switched from one answer to the other.

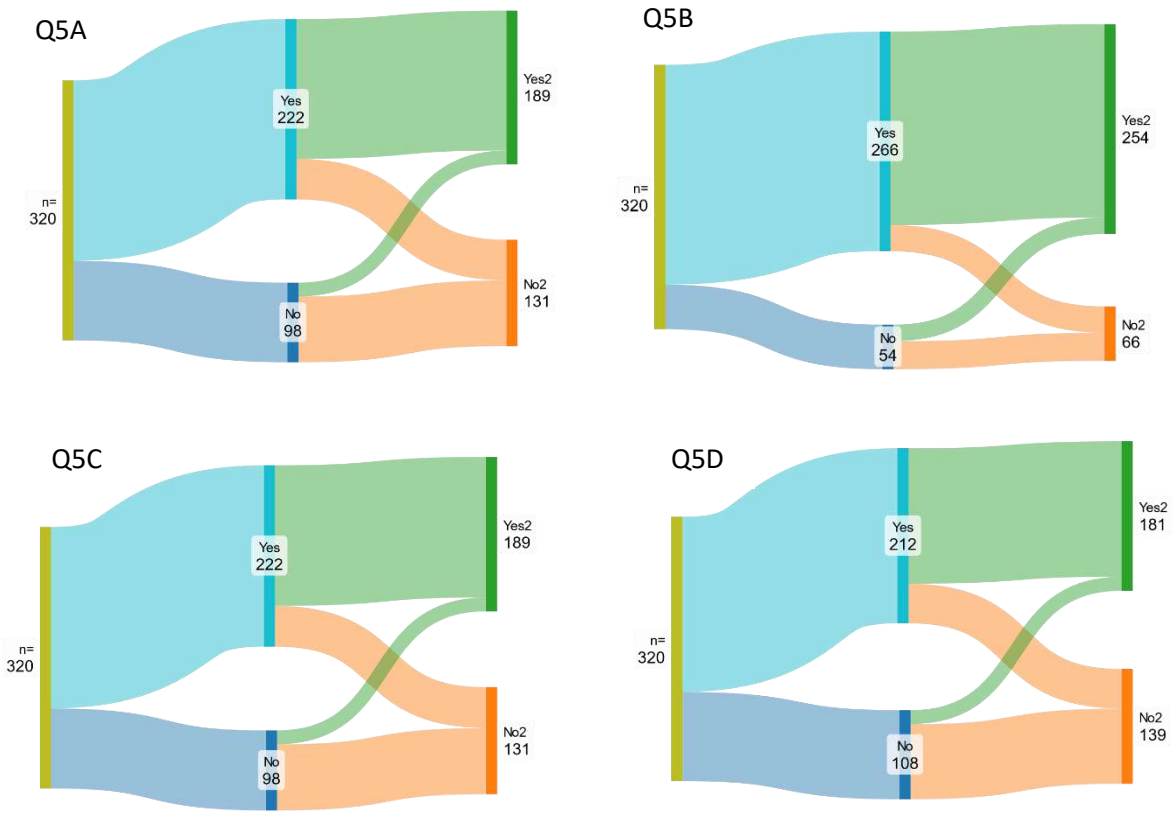

Figure 7: Self-learning tool pre and post survey changes in responses questions 5A-D, *5A: to improve skills needed in a practical dietetic care process, 5B: to be better prepared for a future job as a dietician 5C: to increase self-learning skills 5D: to learn in an innovative way*

Effectiveness and Usefulness of Chatbots

Questions 6 and 7 investigated perceived effectiveness of chatbot for students and usefulness to increase competence in working with patients. There was no significant change in scores between the pre and post survey, with mean of 3.4 for both in the post survey. This indicates that students perceive a slightly above neutral value in terms of effectiveness of chatbots as a self-learning tool and as useful in competence in diagnosis and working with patients. It is positive that students' initial expectations were largely met after interaction with the chatbot but there is room for improvement. Again, incorporating more complex scenarios and using AI to enhance the interpersonal skill development may be useful here.

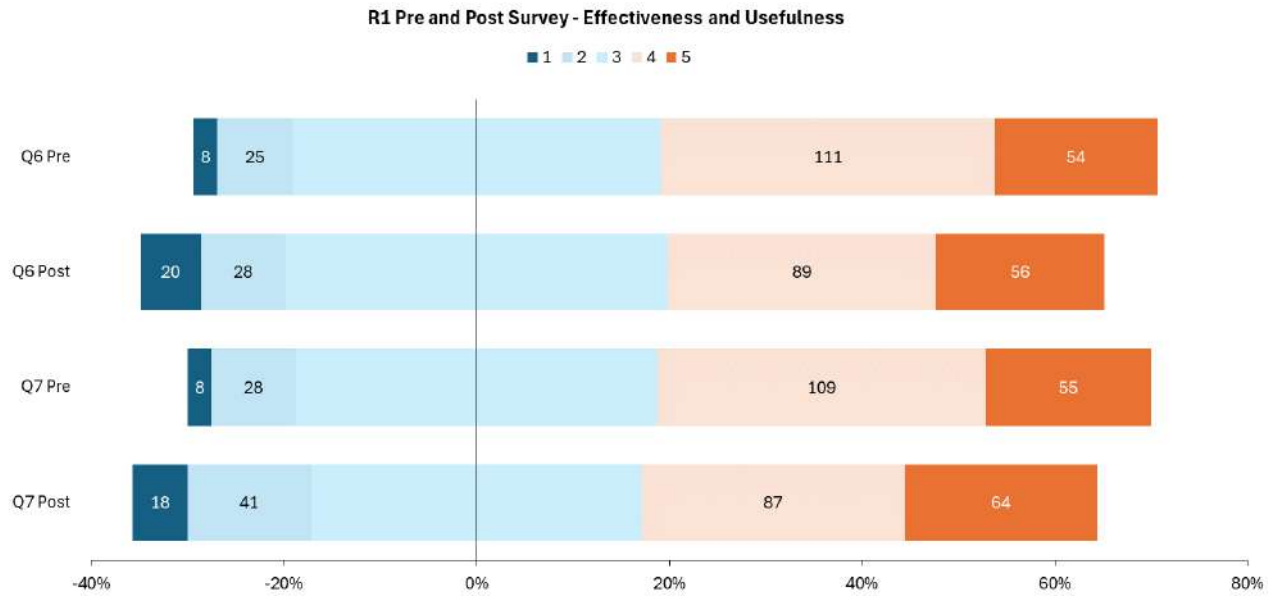

Figure 8: Self-learning tool pre and post survey responses Q6-7

Additional Post Survey Insights

Five questions (Figure 9) were asked only in the post survey as yes/no or agree/disagree responses, that is whether users felt their practical knowledge was updated (Q09: 76.6%), whether new training tools could improve classroom practice (Q10: 88.8%) and whether their interpersonal skills had increased (Q11: 71.9%). Two questions relating to indicators for the project were added at a later point in piloting and thus were answered by only 56 respondents, these were whether participation had increased knowledge of the harmonised dietetic care process (Q12: 73.2%) and whether *interpersonal skills or coaching capacity to benefit future work or current professional practice were improved (Q13: 80.5%)*. The results indicate that most users felt the tool did benefit these indicators and suggests it may be a useful addition to dietetic education.

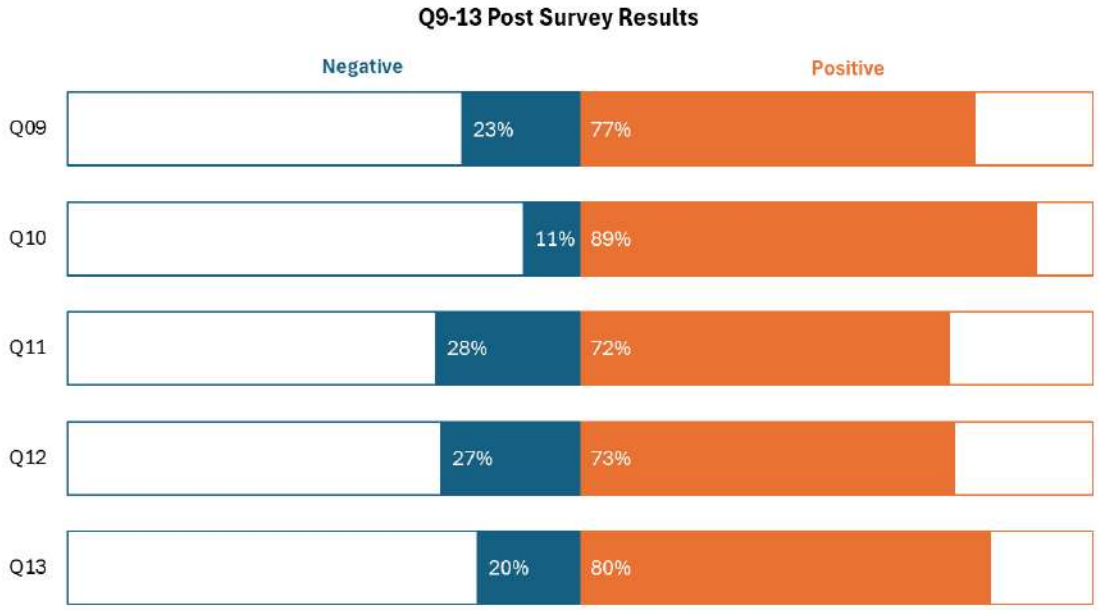

Figure 9: Question 9-13 Responses, Yes or agree responses indicated as “positive” and no or not applicable indicated as “negative”

Lessons learned

The results of the participant survey indicates that the piloting successfully introduced and familiarized a significant number of dietetics students and professionals with chatbot technology as a self-learning tool. There was statistically significant improvement in users' knowledge and skills in using chatbots, highlighting the potential of such tools in modern dietetics education. However, the relatively modest increases in scores suggest that there is still room for improvement in how the chatbot is integrated into the learning process, which will be considered during the writing of the “4.2 Report on recommendations for dietetics education addressed to trainers and managing boards” . Additionally, the decline in expectations related to job preparedness and innovative learning after interacting with the chatbot indicates that initial enthusiasm may not have been fully sustained, possibly due to the tool's limited complexity and evolving user expectations influenced by advancements in AI technology.

Recommendations

To enhance the effectiveness of the chatbot as a self-learning tool in dietetics education, it is recommended to incorporate more complex case studies that mirror real-world scenarios. This could help in bridging the gap between basic skills training and practical job preparedness. Additionally, integrating generative AI models could broaden the scope of interactions and provide a more dynamic learning experience, with particular focus on interpersonal and counselling skills. To address the observed decreases in expectations, future implementations should consider providing more structured classroom activities that complement the self-learning tool, along with additional resources on the role of chatbots in healthcare. Lastly, further investigation into the reasons behind negative responses during future roll outs could provide valuable insights for refining the tool and ensuring it meets the diverse needs of its users.

3.3.2 Feedback from Partners

Following the piloting activities, project partners were asked to give feedback written or in meetings to their experiences with the platform including which student groups participated in piloting, additional feedback collected locally, observations and opinions on the piloting process, and suggested improvements. The result of that feedback is in the following section. Table 2 provides an overview of the piloting activities undertaken at each partner institution.

Table 2: Summary of Partner Institution piloting activities

Institution	Groups Participating in Piloting	Number
UNEAT	Year 1 - Anthropology	45
	Year 2 - Assessment of Nutritional Status and Body Composition	22
	Year 3 - Diet Therapy I	27
	Year 4 - Dietary Prescription	26
AP University	5 group sessions outside regular classes on campus	37
	Colleagues and Dietitians	12
University of Porto	Bachelor's degree in Nutritional Sciences (Biostatistics), 4 classes of approx. 45 minutes each	50
FH Sankt Pölten	Bachelor Dietetics Students Semester 1 (Communicating for health and nutrition - English) Semester 3 (Dietetic Consultation- English) Semester 5 (Project Management- German)	63
	Teachers from Dietetics Department	3
UJK	Year 1- basics of clinic dietetics	116
	Year 3- Dietary counselling	
	Masters' dietetics – prophylaxis of diet and disease	
UvA	Piloting ongoing at time of report	N/A

It is immediately clear that partner institutions piloted in a wide variety of classes with students, representing differences in student availability and program structure. Some piloting was highly structured, being integrated into classroom lesson plans with extensive explanation of the goal of the platform and how to use it with feedback provided by instructors. In other scenarios students were given less instruction and were free to test it in their own time.

Additional Piloting/Dissemination activities

Partner institutions carried out additional piloting and training activities including online campaigns to attract users from the broader student body, alumni and other networks. There were opportunities to present and pilot the platform at various conferences, international week activities, and student project presentations.

Impact on participants with fewer opportunities

One of the targets of the project is to reach 390 participants with fewer opportunities over the course of all project activities. This includes people with geographical, health, economic, social or migrant background

obstacles. While reach to this group was not directly measured partners were asked to give feedback on how their piloting activities supported access by these groups. For the self-learning tool, the target is primarily students. Partners noted that the online availability of the tool meant students who were sick were still able to participate in the activities from home. There was an online campaign targeted to the students at the online university of FUNIBER participating in nutrition programmes. These students in particular may benefit from the self-learning platform as they have more limited access to practical experience than traditional dietetic programmes.

While it was not measured directly during piloting, the partners hypothesise that the online nature of the self-learning tool could support students or dietitians with a variety of barriers including limitations to on-campus access, students who are sick and miss classes, and students with language limitations who may benefit from more time to practice.

3.3.2.1 Partner Specific Feedback

UNEAT

Description of Activities:

- Conducted piloting activities across different academic years and courses, including Anthropology, Assessment of Nutritional Status, Diet Therapy, and Dietary Prescription.
- Activities involved in-class interactions with the chatbot and subsequent self-assessment. Students were given some coaching prior to piloting on the dietetic care process and after completion of the chatbot-interaction there was class discussion of each case.

Feedback:

- Students appreciated the detailed responses from the chatbot, particularly regarding blood test results and referral letters.
- Common difficulties included the chatbot's inability to handle complex or emotionally nuanced questions, leading to irrelevant or contradictory answers.
- Suggestions for improvement included expanding the chatbot's answer pool and enhancing its ability to understand more varied questions.

AP University of Applied Sciences

Description of Activities:

- Organized four group sessions on campus, supervised by a researcher, and included additional sessions during an international week.
- Students tested the chatbot in both Dutch and English and provided feedback.

Feedback:

- Students found the chatbot useful for learning and practicing questioning techniques but noted it often required very specific queries.
- The chatbot's lack of emotional intelligence and some strange responses were cited as areas needing improvement.
- Technical issues, such as text fitting within the frame and the inability to use motivational interviewing techniques, were highlighted.
- Self-assessment questions to rigid and not adapted to the individual cases

University of Porto

Description of Activities:

- Piloting conducted primarily in January and February 2024, involving nutritionists, teachers, and students (mostly attending the bachelor's degree in Nutritional Sciences).
- Piloting activities took place in classes (around 45 minutes per session), and additional piloting was conducted via email requests.

Feedback:

- The chatbot was seen as a good digital tool, although with limitations in its responses.
- Suggestions for improvement included making the self-assessment more aligned with actual nutritional diagnostic terminology used in Portugal.
- Several participants reported that the chatbot was mainly replying to words, rather than real-life information.

FH Sankt Pölten

Description of Activities:

- Piloting involved semester 1 and semester 3 bachelor dietetics students in classes on dietetic consultations in English, as well as semester 5 students who developed supporting classroom materials and plans as part of a project management class and delivered to the semester 1 students.
- Activities included interaction with the chatbot in class and feedback from both students and teachers via survey.

Feedback:

- Students noted the need for more human-like interaction and better handling of patient-centric approaches to align with the focus on interpersonal skills in the dietetic program.
- Technical issues with accessing lab results and the need for better translation accuracy in German.
- Self-evaluation is too vague and does not provide enough context or feedback.
- Educators suggested that while the chatbot could be useful for vocabulary training in English, it needed significant improvements for use in native language counselling.

University Jan Kochanowski

Description of Activities

- Students tested virtual patient platform in dedicated class for Year 1, Year 3 dietetics students and a small group of Masters students.
- Students were given introductory information, asked to complete 1 case per class with post-test discussions and explanations including grading of interaction.

Feedback

- Students had to ask a lot of questions during class such as what to do when there was no answer or wrong answer from the chatbot, how to move forward.
- Teachers noted that the exercise highlighted problems in the student's history taking techniques such as lack of structure and inappropriate questions which created a learning opportunity during the discussion phase.
- Students overall did not like the tool due to frustrations with technical errors and questions with no answers.

- Self-assessment questions were not relevant or helpful to students.
- Project partners also highlighted that there were differences in the way cases were developed between the partners countries which made training and improving the bots difficult. There were also technical issues causing piloting to be repeated multiple times.

3.3.2.2 Common Insights

Through synthesis of the partners experiences in piloting there are some common themes that provide valuable insight into the piloting process, its successes and areas for improvement.

Useful for Beginners

Students and teachers found the tool has potential to be useful, particularly in the beginning phases of dietary counselling technique where there may be a focus on structure rather than more advanced interpersonal skills. However, the tool's utility varied based on its alignment with specific educational frameworks and terminology used in different countries. For example, in one case the tool was used in an English language class on dietetic consultation. As this is a second language for the students the more simplistic aspects of the tool were beneficial for vocabulary training and there was less need for higher level interactions. This highlights that integration of the platform into the educational curriculum should ensure customisability and adaptability to local educational standard, practices and an ability to tailor it to the specific needs of individual classes

Understanding and Response Limitations

It was observed that the chatbots often struggled to answer general queries or more complex questions, either giving no answer or incorrect responses. This is partially expected during the piloting phase as the initial interactions provide the training material needed to improve the AI's understanding and responses. However, it also represents a limitation of the type of AI used, which uses natural language processing to understand user queries but has hardcoded responses as opposed to a generative model that can freely develop responses to users' questions. This means the answers are finite and relies on the creator for the level of detail and comprehensiveness. As users may now be more familiar with interacting with generative AI platforms, this limitation may have a greater impact. It also can hamper the learning experience as students are not able to truly mimic real-life patient interactions where there is essentially an unlimited number of directions a conversation can take. Future iterations of this platform would do well to integrate modern large language models to enhance the chatbots ability to understand and respond to a broader range of questions.

Emotional intelligence and student engagement

A key limitation reported by many users is the chatbots lack of ability to address questions involving emotions, motivation and other detailed aspects of a patient's life and feelings. For many of the dietetic students, the practice of interpersonal skills, coaching and general emotional intelligence is a key part of the dietitian and patient interaction. Thus, this gap resulted in a lack of depth in the interaction and minimised the realism achieved, which for some users reduced motivation to use the tool. Common feedback was that while the tool has potential, it needs refinement and increased capacity for free interactions to meet user expectations.

As before, integration of generative large language models which are extremely effective at mimicking

human emotion could be a key improvement and help to incorporate more dynamic and engaging patient scenarios.

Refinement of self-evaluation

The current format of the self-evaluation was found to be inadequate to meet user needs. The self-evaluation uses the International Dietetic Nutrition Terminology and requires students to assign the virtual patient to certain categories of that terminology. As most of the partner institutions do not use this terminology, instead opting for the Nutrition care process terminology or the ICF-dietetics (or local variations), majority of the students were not familiar with the terms. Originally, the self-evaluation was conceptualised as each case having a set of questions developed for the self-evaluation, however this was reduced to the IDNT terms due to time- and technical constraints. In future iterations of the tool it would be best to fully develop the self-evaluation to tailored case-based questions independent of a specific terminology in order to generalise the applicability.

Technical Issues

Participants reported technical difficulties, such as the unavailability of lab results, browser compatibility problems, and issues with text fitting within the chat window. Such issues can disrupt the learning process and reduce the effectiveness of the educational tool. While technical problems are to be expected in piloting phase of testing, it is important that the identified problems are addressed to ensure seamless access and usability.

In general, it appears that across institutions and testing scenarios, users appreciated the self-learning tool as an addition to classroom practice but faced challenges with the limited responses. The pilot highlights the need for more comprehensive and contextually accurate responses and the integration of modern large language models to improve its utility.

Lessons learned

Feedback on piloting across the partner institutions provided valuable insights into the E+Dieting_Lab's potential as an educational tool and the challenges it currently faces. The tool was found to be particularly useful for beginners in dietary counselling, especially in scenarios where the focus is on developing basic structure rather than advanced interpersonal skills. However, its effectiveness varied depending on the alignment with local educational frameworks and terminology, highlighting the need for greater adaptability and customizability. A significant limitation identified was the chatbot's struggle to handle general queries and complex questions, leading to incorrect or incomplete responses. This issue, compounded by the chatbot's innability to mimic emotional intelligence, hindered its ability to fully engage students in realistic patient interactions. The current self-evaluation component was also found to be inadequate, as it did not align with the terminology or educational practices of many partner institutions. Additionally, technical issues, such as browser compatibility and text fitting problems, disrupted the learning process, reducing the tool's overall effectiveness.

Recommendations

To enhance the effectiveness of the E+Dieting_Lab platform, several recommendations are proposed. First, integrating modern large language models into the chatbot would significantly improve its ability to understand

and respond to a broader range of questions, including those implying emotional intelligence. This would create more dynamic and engaging patient scenarios, better preparing students for real-world interactions. Second, the self-evaluation component should be refined to include case-based questions tailored to the specific educational needs and terminology of each partner institution. This would increase the tool's relevance and applicability across different contexts. Third, the platform should be made more customizable and adaptable to local educational standards and practices, allowing instructors to tailor its use to the specific needs of their students and curricula. Finally, addressing the reported technical issues, such as improving browser compatibility, is crucial to providing a smooth and effective learning experience. Implementing these recommendations would significantly enhance the platform's utility as a self-learning tool in dietetics education.

3.3.3 Feedback from Technicians

Feedback was collected from the development teams from UNEAT and UvA on technical challenges, problems and solutions encountered during the pilot phase.

Reported Issues

- **Inadequate/ inconsistent Responses:** Sometimes the chatbot does not provide accurate or relevant responses, which can cause frustration among users.
- **Intent Configuration:** There is difficulty in correctly configuring intents in Dialogflow, which is crucial for adequately responding to user queries.
- **Nutritionists' Integration:** Directly incorporating nutritionists in creating intents in Dialogflow poses a challenge due to their lack of previous experience with the tool.
- **Maintaining Coherence:** Maintaining coherence in the conversation's flow can be challenging, especially in extended interactions.
- **Browser Compatibility:** There are issues with the chatbot loading in certain browsers.
- **API Errors:** Errors in API configuration can occur, affecting the chatbot's functionality.
- **Translations:** Translating conversations into five different languages posed a significant challenge during the chatbot implementation. The need to maintain consistency and accuracy in responses in each language presented several technical obstacles.

Resolution Strategies

- An exhaustive analysis of the most common user queries was conducted, and the intents and responses of the chatbot were adjusted to improve the accuracy and relevance of the answers.
- User feedback was collected and analysed to identify problem areas and adjust the conversation flow accordingly.
- The official documentation from Google and Botcopy was thoroughly reviewed to ensure correct API configuration and integration parameters.
- Iterative testing was conducted to identify integration failure points and systematically resolve them.
- The DialogFlow language model was trained with more representative data, and parameters were adjusted to enhance accuracy.

- Intentions and entities defined in DialogFlow were reviewed and improved to ensure proper understanding and precise responses to queries.
- Usability tests were conducted with real users to identify issues in the interface and make necessary adjustments.
- The chatbot interface was redesigned to improve intuitiveness and usability, ensuring a positive experience across all devices.
- Contexts were used in DialogFlow to maintain conversation state and manage interaction flow effectively.
- Exhaustive testing was conducted on different devices and browsers to ensure compatibility.
- Additional training was provided to developers and nutritionists on how to properly structure intents in DialogFlow. Detailed guides were created, and practice sessions were offered to enhance technical competence on the platform.
- Scripts and tools were developed to facilitate management by nutritionists using the DialogFlow tool.
- An automated translation system was implemented and a process of continuous review was established to adjust and improve translations based on user feedback and to maintain consistency in the tone and style of responses in each language

Outstanding Technical Challenges

- Improving the accuracy and relevance of the chatbot's responses remains a challenge, especially in complex or specific query scenarios.
- Continuing to train the chatbot's language model with additional data and adjusting parameters to maintain and enhance its effectiveness.

User Experience

- Performance Metrics
  - Average Response Time: Most responses are delivered in less than 2 seconds, which is acceptable for most users.
- User Feedback
  - Some users mentioned that the chatbot's responses were not always accurate or relevant to their specific questions.
  - Some users reported issues with loading the chatbot on certain browsers, which affected their usage experience.
- Suggestions for Technical Improvement
  - It has been suggested to improve the language model and refine the intent configuration to ensure more precise and relevant responses to user queries. This improvement aims to optimize the chatbot's understanding and interaction capabilities.
  - Recognizing the diversity of the users, it is recommended to modify the expressions and phrases of the system to align them with the cultural peculiarities of each country. This would not only improve the relevance of the responses but also increase user satisfaction by feeling that the system understands and respects their cultural context.
  - There is a recognized need to review and update the questions asked in the initial and final interviews. These changes aim to ensure that the questions are more inclusive, relevant, and effective in gathering valuable information about the user's experience, thus facilitating continuous improvement of the system based on concrete and significant feedback.

Lessons Learned

The feedback from the technical teams at UNEAT and UvA during the pilot phase of the E+Dieting_Lab platform revealed several key challenges and insights that are crucial for future development. A primary issue was the chatbot's occasional inability to provide accurate or relevant responses, which led to user frustration. This problem was linked to difficulties in configuring intents within Dialogflow, especially when incorporating nutritionists who lacked experience with the tool. The challenge of maintaining coherent and consistent responses throughout extended interactions further complicated the user experience. Additionally, technical issues such as browser compatibility problems, API errors, and the complexity of translating conversations into five different languages posed significant obstacles. Despite implementing resolution strategies, such as iterative testing, adjusting intents and entities, and training the language model, improving the chatbot's accuracy and relevance remains a persistent challenge.

Recommendations

To address the technical challenges identified, several recommendations are proposed. First, it is crucial to continue enhancing the chatbot's language model by training it with more representative and diverse data. This will improve the accuracy and relevance of the responses, particularly in complex or specific query scenarios. Second, refining the intent configuration in Dialogflow should be prioritized, with additional focus on integrating nutritionists more effectively into the process. Third, ongoing efforts to improve browser compatibility and resolve API errors are essential to ensure a seamless user experience across all platforms. Additionally, the automated translation system should be continuously reviewed and adjusted to maintain consistency and cultural relevance in the chatbot's responses. Finally, it is recommended to revise the questions asked during the initial and final user interviews to ensure translations are correct and effective in gathering meaningful feedback. These improvements will not only enhance the chatbot's functionality but also ensure a more culturally sensitive and user-friendly experience, ultimately increasing user satisfaction and engagement.

4. Digital Lab for Education in Dietetics – Service Learning / Trainers Tool

To enhance practical training in Dietetics Education and promote a community/service-learning approach related to nutrition, a digital environment has been created for conducting synchronous patient interviews within a controlled setting. The service learning/trainers tool is essentially a telehealth platform comprised of 6 clinics, one for each partner institution. Users, that is students, teachers, dietetic supervisors, dietitians and community members, can register on the platform and book and manage appointment slots.
The exact form that this interaction takes can differ depending on the user. For example, it can be used to facilitate supervised dietetic consults for students with real patients, or it could be used for role play, or group education session etc. Figure 8 shows a view of the clinic selection screen on the website.

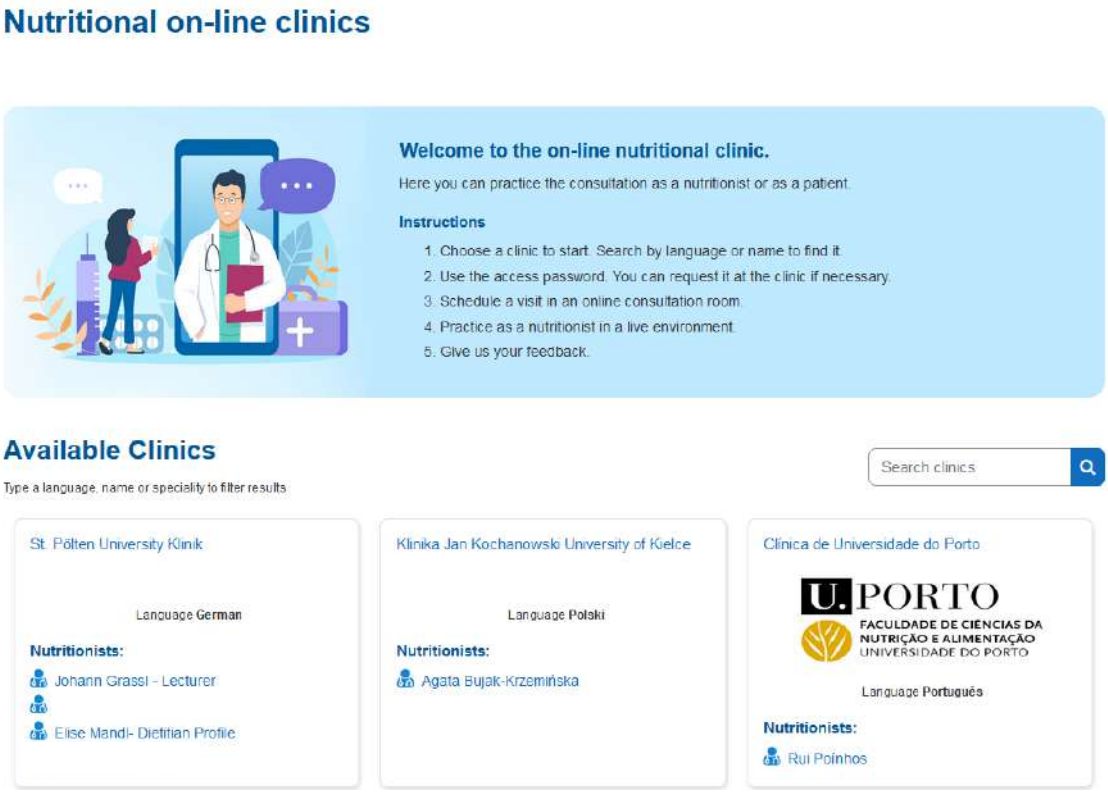

Figure 10: View of the clinic selection screen

In the clinic, the learner will be able to interact with individuals (potential patients) in a supervised mode due to the option of having a supervisor present. Prospective dietitians can then interact with real or role-play patients to improve their anamnesis skills or other aspects of the dietetics care process based on the harmonized dietetic care process model outlines by Vanherele and colleagues (2018) – Figure 11.

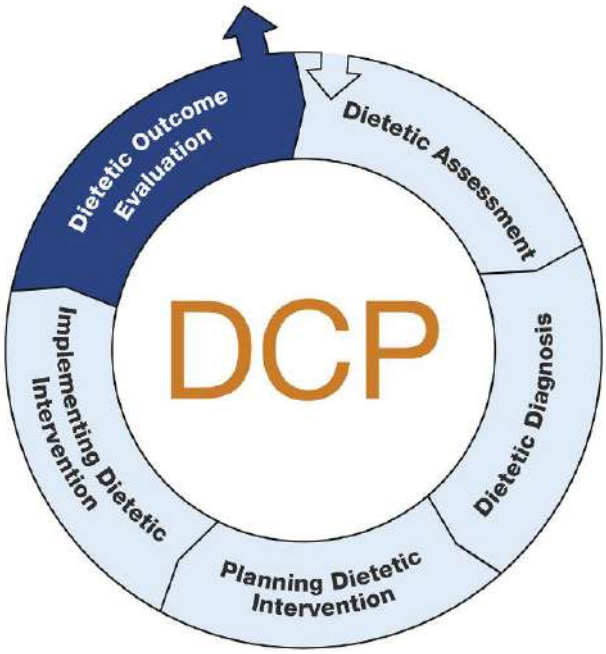

Figure 11: Harmonised European Dietetic Care Process (DCP)[6]

The platform itself is comprised of a website, where users can register and then join one of the 6 available clinics corresponding to each project partner. Once in a clinic, dietitians or students acting as dietitians can create appointment slots that can be selected by patients or role-play patients. The actual appointment itself then follows as a video telehealth call that allows real-time interaction and sharing of information. More specific use-case scenarios are outlines in Report 2 of the Multiplier Toolkit: Report on Recommendations for Dietetics Education Addressed to Trainers and Managing Boards.

Finally, there is the option to create a recording of the patient interview which can be used for a planned extension of this tool, namely AI supported generation of new patient cases for the creation of new virtual patients for the self-learning tool discussed in section 3. This feature is not yet fully implemented however the supporting structures are described in the following section.

The goal of this service-learning tool is to develop students' skills in dietetic counselling of patients and provide a platform for community outreach activities. Specific classroom implementations, learning outcomes and syllabus integration are detailed in Report 2 and 4 of the multiplier toolkit. Additional applications for dietitians outside of education are detailed in report 3.

4.1 Technical Description of Service Learning/ Trainers Tool

Software and Interfaces

Website: The service learning tool is located at https://clinic.edietinglab.eu/. The website enables user registration and login and hosts the Moodle environment.

Moodle: Moodle is the central axis of the virtual clinic, used as the Learning Management System (LMS) to organize and manage courses and clinical interactions. Specific customizations within Moodle have been made to adapt it to the needs of the project, including theme customization, modules, and the integration of additional functionalities for bookings and appointment management.

BigBlueButton: is an open-source web conferencing system designed specifically for online education but adapted in this case for the needs of virtual consultations and meetings in a clinical context. It is integrated with Moodle through a plugin that facilitates the scheduling and conducting of consultations directly from the learning platform.

PHP: is a server-side programming language used for web development. In the virtual clinic, PHP is used to create dynamic scripts that interact with the database and web server.

MariaDB: is an open-source database management system, derived from MySQL, which serves as the backend for storing all Moodle data.

Debian 11 and Ubuntu 20.04 LTS are the operating system platforms used on the virtual machines hosting Moodle and BBB, respectively.

APIs and Third-party Services

- Google Cloud Platform (GCP): The virtual machines of Google Cloud host the main infrastructure of the project, including the servers for Moodle and BigBlueButton.
- APIs of BigBlueButton: BigBlueButton provides an API that allows integration with Moodle and other content management systems, facilitating the organization and conduct of video conferences directly from the educational platform.
- Dialogflow: Used to analyse and understand user interactions during consultations, helping to identify intents and improve automated interaction.
- ChatGPT (from OpenAI): Employed to generate textual responses to user inquiries, based on a language model trained on a wide range of data.
- Scheduler Plugin: Facilitates the management of appointments and reservations within Moodle, allowing patients to schedule and manage their consultations with health professionals.

User interactions

Users interaction with the platform in several key ways

- Registration and login to a clinic
- Managing booking slots
- Creating appointments
- Attending appointments
- Completing user surveys pre and post appointment
- Profile administration

The registration process is detailed in figures 12 and 13 below.

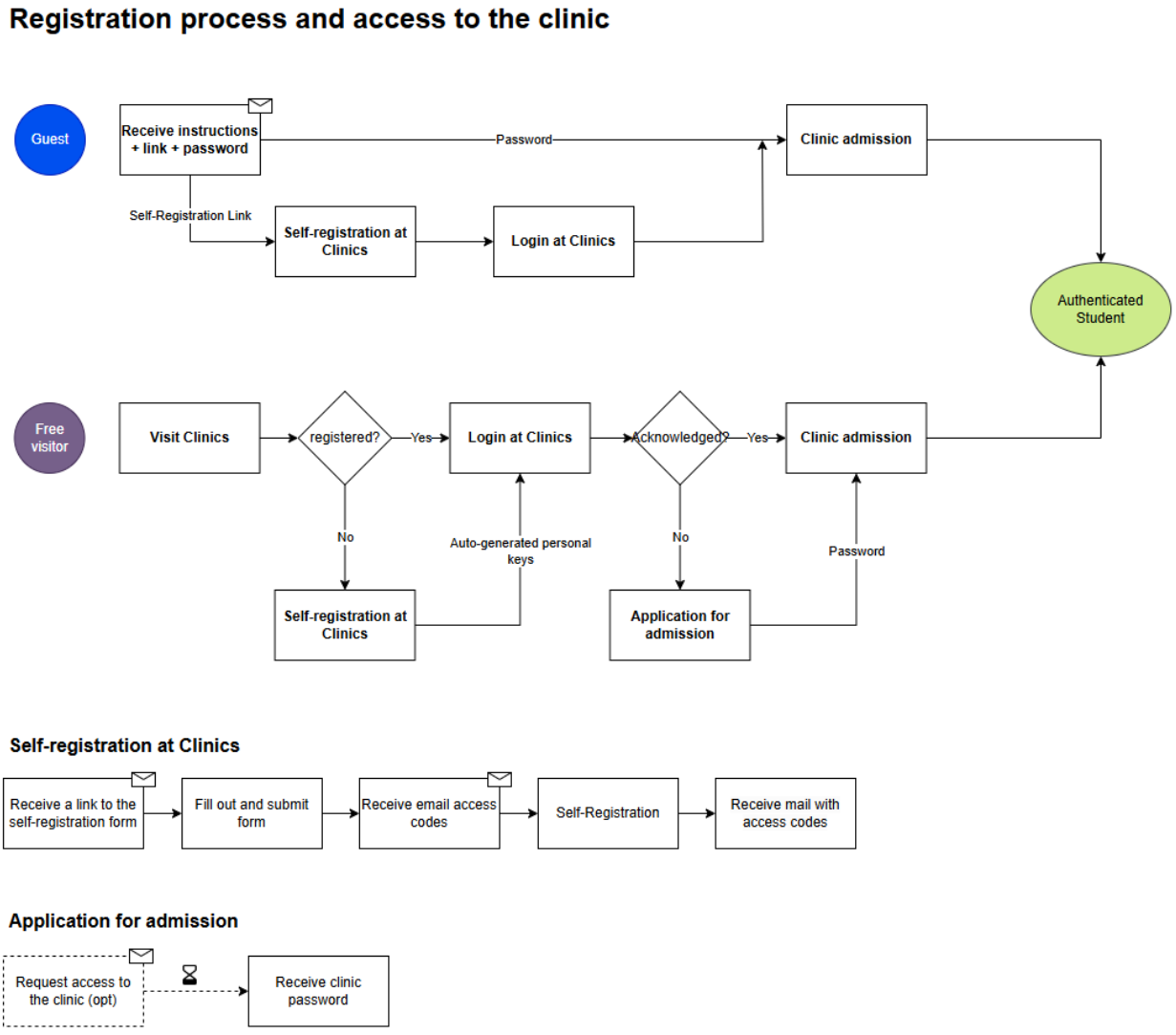

Figure 12: Registration process for service-learning tool

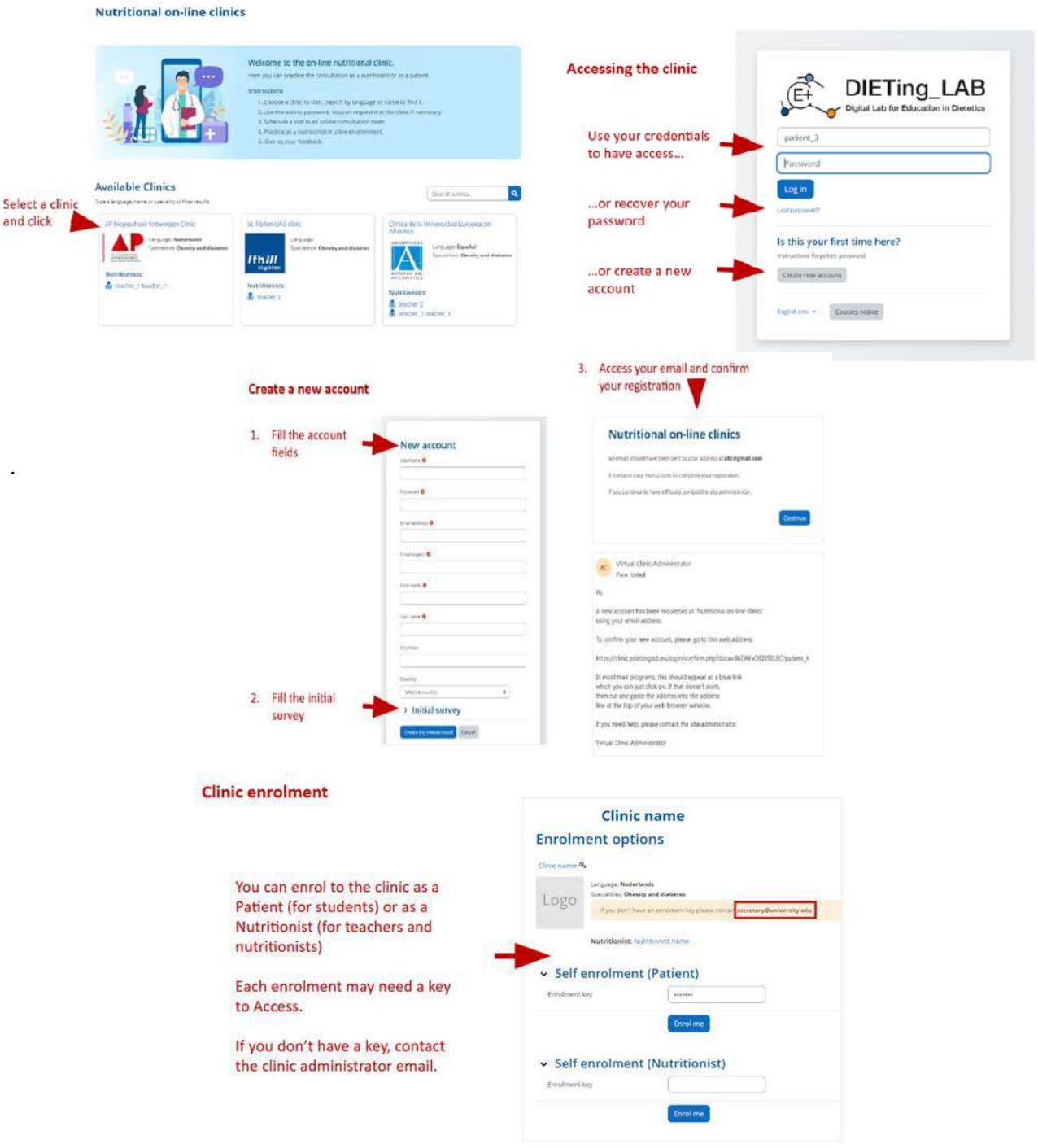

Figure 13: Registration and clinic enrolment user view.

Step 1: Select a clinic, Step 2: Login or create a new user Step 3: Create account, fill in initial survey and receive confirmation email Step 4: enrol in clinic.

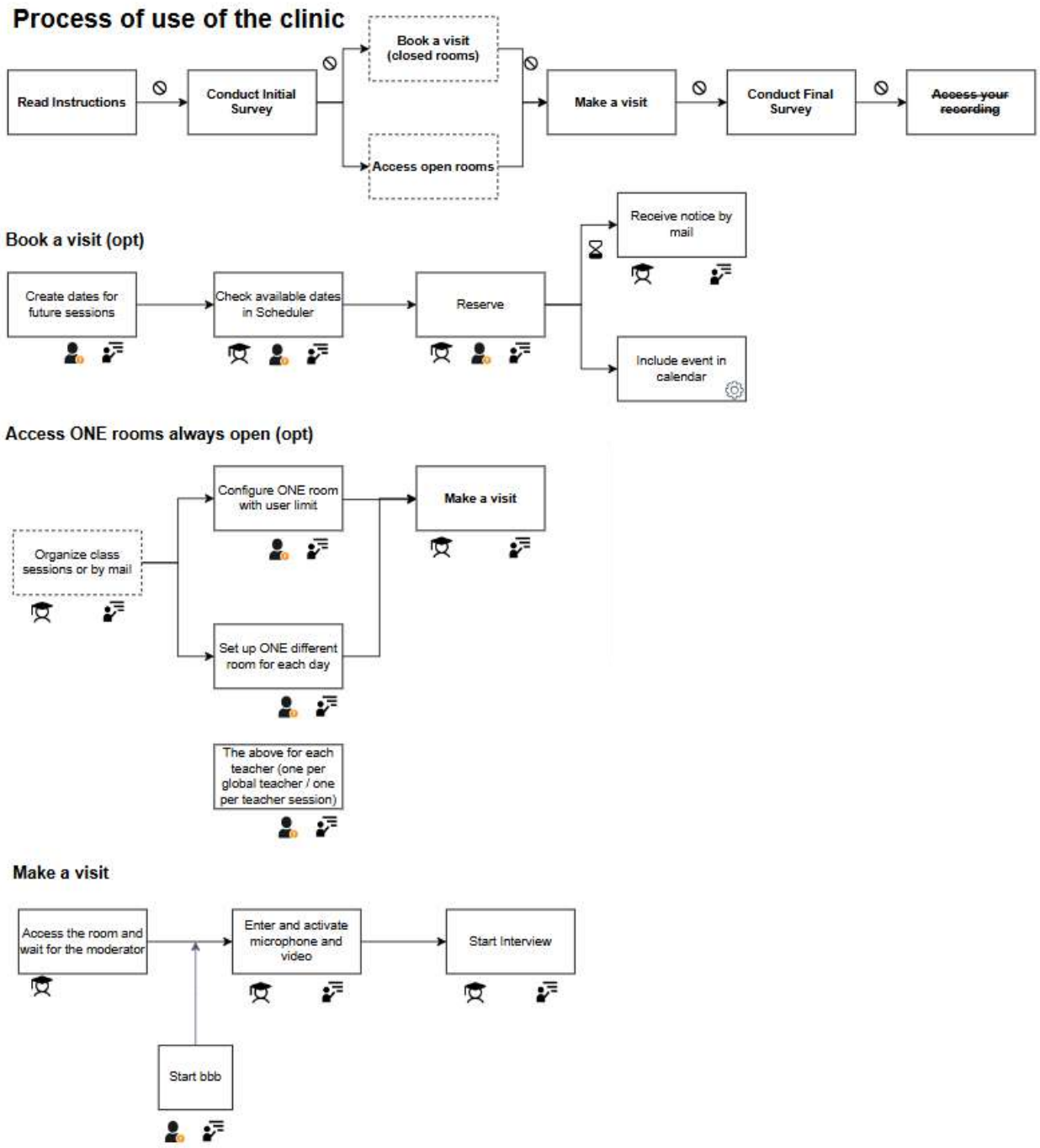

Figure 14: Use of clinic for booking and attending appointments

Figure 14 highlights the interaction of users with the clinic post registration including booking and attending appointments within the online clinic.

Conversion of Patient interactions to new virtual patients

Figure 15 demonstrates the interfaces and steps required to extract data from recorded dietetic consult sessions to make a new virtual patient for the self-learning tool.

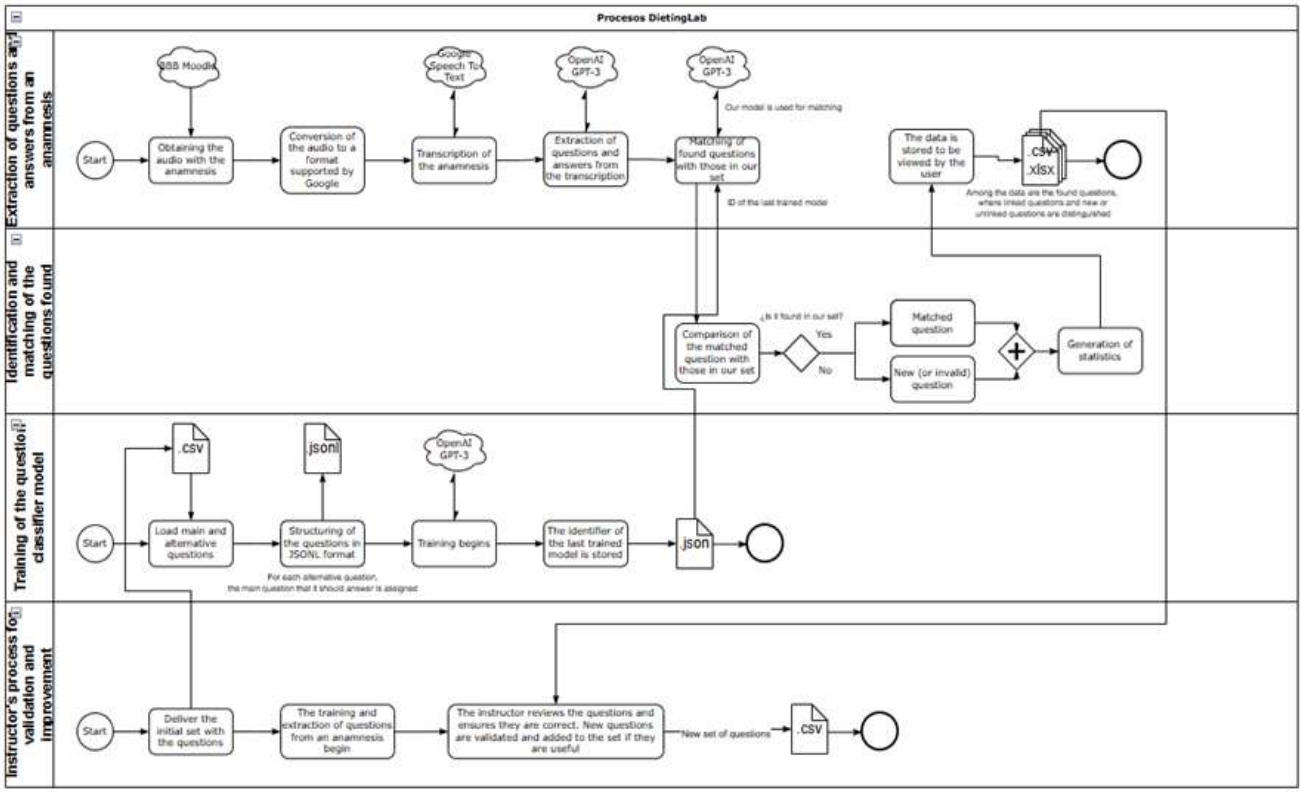

Figure 15: Conversion of patient interviews to virtual patient chatbot

Licenses

Moodle: GPL is an open-source LMS. The GPL license allows users to copy, modify, and redistribute the software, even in a modified version, under the condition that the same freedoms are preserved in redistributed versions and that the source code is accessible.

BigBlueButton: is an open-source web conferencing system. The LGPL license allows users to use, modify, and redistribute the software freely, provided that any modifications to the original software or linked software are also under the same LGPL license.

MariaDB: being a fork of MySQL, remains open-source under the GPL license, which permits the use, distribution, and modification of the software as long as these activities adhere to the terms of the GPL.

Debian and Ubuntu: Both Debian and Ubuntu contain software that may be under different open-source licenses. Most components are licensed under the GPL, allowing broad freedom in terms of use and distribution.

PHP: This license is a free software license, non-copyleft, specific to PHP, and allows the use, modification, and distribution of the software.

Google Cloud Platform, Dialogflow, and ChatGPT: These services are provided under commercial terms with licenses defined by Google and OpenAI, respectively. The licenses for these services generally allow the use of the service within agreed limitations, such as the number of queries, amount of data processed, etc., and are subject to recurring or usage-based costs.

Moodle Plugins: Plugins and themes of Moodle are generally available under open-source licenses, allowing their modification and redistribution under the same terms.

Infrastructure and Hosting

The virtual clinic is built on a solid and flexible infrastructure, with Moodle serving as the primary Learning Management System (LMS), enhanced with particular plugins and distinct servers for extra capabilities.

Google Cloud platform hosts the virtual clinic, where it uses specially tailored virtual servers to maintain its operations. The services provided are clinic.edietinglab.eu on one virtual machine, and bbb.edietinglab.eu on a different virtual machine, specifically tuned for the BigBlueButton service.

Server Specifications

The virtual clinic is based on two main virtual machines hosted on Google Cloud, which are used for different purposes within the project: one for Moodle and its plugins, and the other dedicated to the BigBlueButton service. The technical specifications of each server are as follows:

- Virtual Machine for Moodle (clinic.edietinglab.eu and virtual-patient.edietinglab.eu)
    - Operating System: Uses Debian 11 based servers.
    - Capacity: 2 Intel Xeon CPUs at 2.20 GHz, 4 GB RAM, 50 GB disk storage (standard).
    - Additional Software: PHP version 7.4.33, MariaDB version 10.5.23, Moodle version 4.1.4+
    - Server Location: The infrastructure is hosted on Google Cloud, which allows selecting from multiple data center locations worldwide.
- Virtual Machine for BigBlueButton (bbb.edietinglab.eu)
    - Operating System: Ubuntu 20.04 LTS
    - Capacity: 2 Intel Xeon CPUs at 2.20 GHz, 8 GB RAM, 60 GB balanced disk storage
    - BigBlueButton Version: 2.6.10
    - Server Location: Like the virtual machine for Moodle, it is located in Google Cloud, benefiting from the high availability and redundancy offered by this provider.

Data Storage

The data generated and managed by Moodle, such as user records, appointment details, survey results, and course activities, are stored in a MariaDB database.

Security Measures

Data Encryption

- Encryption in Transit:
  - **Methods Used:** All data transferred between users and the virtual clinic servers is encrypted using the HTTPS (HyperText Transfer Protocol Secure) protocol, which employs SSL/TLS (Secure Sockets Layer/Transport Layer Security) to ensure that the communication is secure and protected against interceptions and man-in-the-middle attacks.
  - **SSL Certificates:** SSL/TLS certificates provided by trusted certification authorities are used to secure all connections to the platform.
- Encryption at Rest:
  - **Database:** Data stored in MariaDB databases is encrypted at rest using AES-256 encryption, one of the most robust standards available.
  - **Files and Backups:** All files and backups stored on Google Cloud servers are also encrypted using strong encryption technologies, ensuring that the data remains protected even if the disks are physically accessed.

Compliance Standards

- **GDPR (General Data Protection Regulation)**: A European Union regulation protecting EU citizens' privacy and personal data. Google Cloud, and thus Dialogflow Essentials, complies with GDPR requirements, including obtaining explicit consent for data collection, ensuring user rights to access and delete data, and notifying security breaches.
- **CCPA (California Consumer Privacy Act)**: A California data privacy law giving residents control over their personal information collected by businesses. Google Cloud adheres to CCPA, providing data collection and usage transparency, and allowing users to opt-out of data sales.
- **HIPAA (Health Insurance Portability and Accountability Act)**: A U.S. law setting standards for protecting medical and health information. Google Cloud offers services configurable to comply with HIPAA, ensuring the confidentiality and integrity of protected health information (PHI).
- **ISO/IEC 27001**: An international information security management standard. Google Cloud is ISO/IEC 27001 certified, ensuring adherence to best practices in information security management.
- **SOC 1/2/3 (System and Organization Controls)**: Reports providing information on internal security controls related to security, availability, processing integrity, confidentiality, and privacy. Google Cloud complies with SOC 1, SOC 2, and SOC 3, ensuring transparency and trust in its security controls.

Technical Support and Maintenance

Support Structure

- Minor Technical Issues: For minor technical issues related to the functionality of the virtual clinic, a support team will respond via emails or direct messages on the website.
- Complex Issues and System Errors: For extremely complex problems or system errors, the issue is escalated to the development team that worked on the implementation of the virtual clinic. They may require direct access to the source code and underlying infrastructure.

Maintenance Plan

- Use the E+Dieting_Lab internal project repository (Basecamp) for continuous communication between the nutritionist partners and the technical team. Updates will be shared here, feedback from the virtual clinic pilot will be collected, and improvements will be discussed based on the end-user experience.
- **Monitoring:** Both VMs are monitored using Google Cloud's Monitoring service, which sends email alerts in case of resource overload or service outages.
- **Backups:** Daily backups of both VMs are performed, with a retention period of up to 14 days.

Update Policy

- Based on the feedback collected in Basecamp, regular updates and improvements will be scheduled and deployed on the virtual clinic to adapt it to the changing needs of users and emerging new technologies.

4.2 Piloting Activities for the Service Learning/Trainers Tool

The service learning/trainers' tool was launched at the beginning of January 2024 and has been continuously piloted since. While there was an initial piloting strategy developed common to all partners, during the piloting phase partners developed their own piloting procedures due to differing course structures, semester plans and student access. Piloting activities included:

- Testing with real patients in supervised internship style clinics
- Testing in a variety of practical and theoretical classes for nutrition and dietetic students
- Group sessions with students outside of scheduled classes
- Invitations for students and alumni/working dietitians to participate at home via email, social media campaigns, conferences
- Student projects
- Testing with dietetic teachers/staff members

Participants were recruited through direct engagement in class, online campaigns and existing internship/clinic structures through some of the partner institutions.

Data collection

The common method of data collection during piloting are the pre and post survey built into the service learning tool platform and completed by users upon registration and after completing their first telehealth appointment. The questions can be found in Appendix 3. Additionally, partners collected feedback from users formally and informally through questionnaire, discussion and observation which was documented during preparations for this report (Appendix 4). Feedback was also gathered from the technical development team for specific information on technical problems and solutions encountered during piloting.

4.3 Results of Piloting

As of the 09.07.2024 there have been 177 registrations on the service learning platform. From these registrations, there have been 129 clinic visits by users, some of these were individual visits and some in group settings. The registered users are 36% male and 64% female. They are made up of 5% dietitians, 24% students, 7% teachers and 64% community members (other), visualised in figure 16 below.

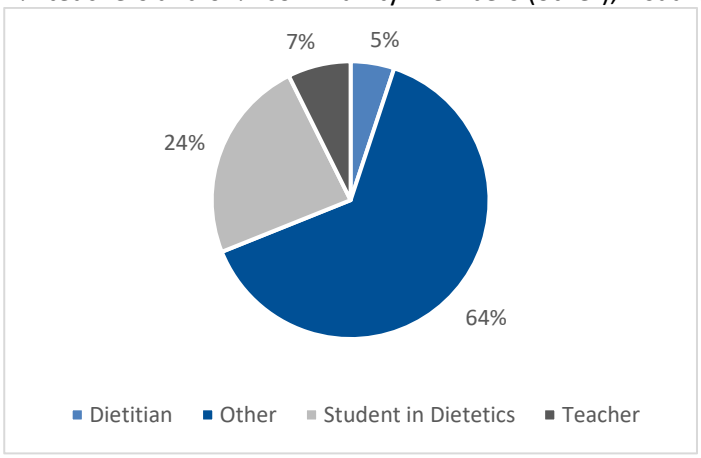

Figure 16: Role of registered users of service learning tool

4.3 1 Results of User Pre and Post Surveys

The E+Dieting_Lab project included a comprehensive pilot evaluation of the service-learning tool through pre and post-surveys. The surveys aimed to assess the expected skills and perceived effectiveness of using a virtual clinic learning tool among dietetics students, teachers and dietitians as well as whether it can be used to provide services to the community to develop healthy habits. Participants completed the initial survey upon registration with the platform and the final survey after completing their first booking appointment with the virtual clinic video/ telehealth platform.

In total 76 users completed both the pre and post surveys representing a response rate of 42%. It can be noted at the outset that there were some technical problems during piloting for users to access the post survey, which is the likely reason for the lower rate of responses. Of that group, 59 completed an additional set of questions in the post survey that were added part way through piloting (Q4,5,7).

Of the 76 participants there were 37% male and 63% female and 68% community members, 22% students, 5% dietitians and 4% teachers, see figure 17 below. Table 3 provides a detailed summary of the key findings based on the survey data collected from participants. It should be noted that all participants were given the same questions, however some questions relate only to students or only to community members. Therefore, totals to the responses are given, but also subgroup numbers relevant to the question.

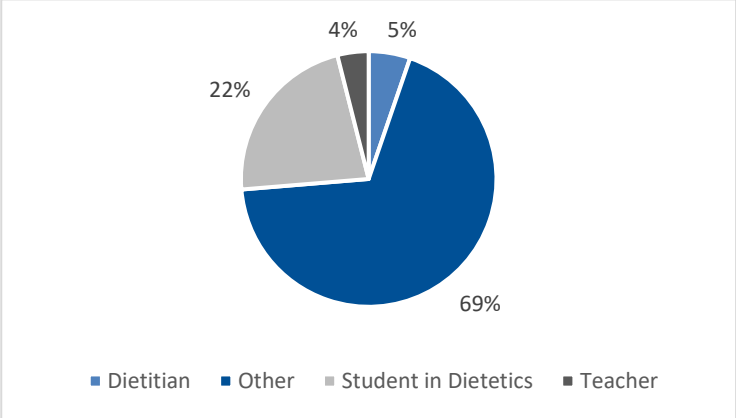

Figure 17: Role of survey participants in service learning tool pilot (n=76)

Usefulness and Effectiveness

Questions 1 and 2 investigated participants opinions on the usefulness of the platform to increase competence in diagnosis and working with patients and the effectiveness for dietetic education. In both these categories the mean response was just over 3 on the 5-point Likert item indicating a relatively neutral opinion. For the student and teachers subgroup (Diet, n = 24), results indicated that for usefulness there is a non-significant small difference between the initial test (*M* = 3.8 ,*SD* = 1.0) and final survey (*M* = 3.5 ,*SD* = 1.1, *p* = .213). For effectiveness there was a non-significant small increase between the initial survey (*M* = 3.3 ,*SD* = 1.2) and the final survey (*M* = 3.6 ,*SD* = 1.2, *p* = .207). The changes in responses are visualised in Figure 158. Overall, the results suggest that participants had a neutral to slightly positive opinion on the platform for these measures that did not change significantly before or after using the service learning tool. This indicates there is room for improvement in these areas. As there werehigh levels of heterogeneity in methods the partners used to test the platforms, future implementations with more structured activities linked into the dietetic curriculum may be essential to improving these domains.

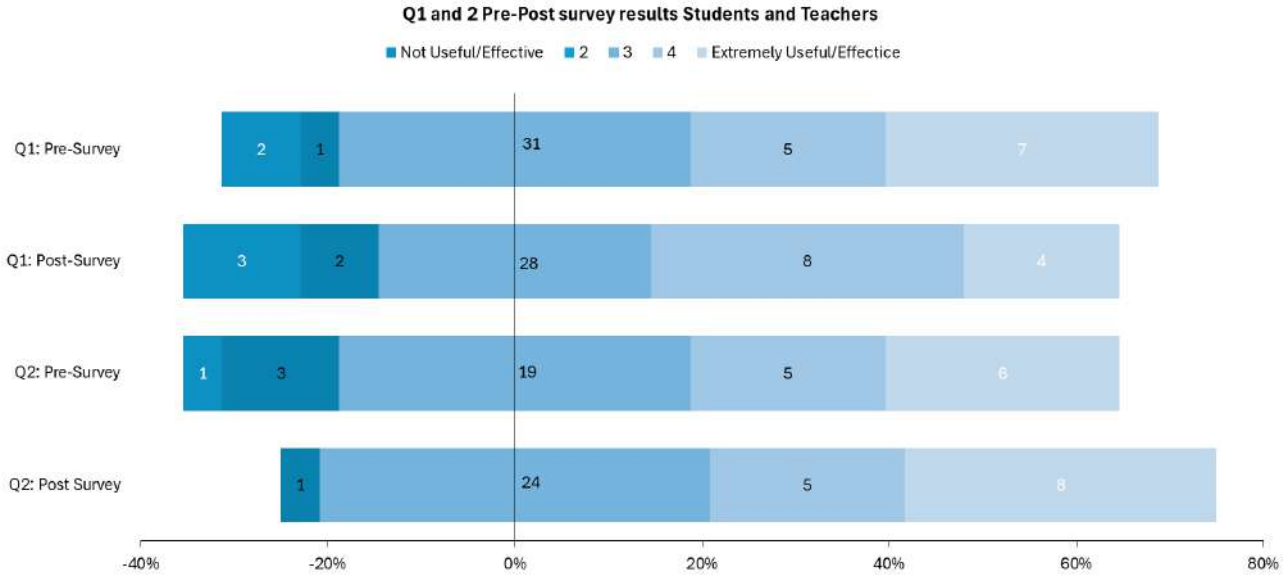

Figure 18: Initial and Final Survey results for Usefulness (Q1) and Effectiveness (Q2) for all Students and teacher n=24

Table 3: Results of Pre- and Post Surveys during piloting of the service-learning virtual clinic. Subgroups are All for all participants, Diet for students, teachers and dietitians and Com for community members.

Question	Pre survey result	Post survey result	Mean difference (Significance)
Q1: Evaluate the usefulness of using a virtual room by dietetics students to increase competence in diagnosis and work with a patient (1-5: not at all useful – extremely useful) (All n=76, Diet N=24)	All: Mean 3.5 Diet: Mean 3.8	All: Mean 3.3 Diet: Mean 3.5	-0.2 (p=0.270) -0.3 (p=0.213)
Q2: What is your opinion about the effectiveness for dietetic education of using a virtual room (1-5: not at all effective – extremely effective) (All n=76, Diet n=24)	All: Mean 3.4 Diet: Mean 3.3	All: Mean 3.4 Diet: Mean 3.6	0.0 (p=0.730) +0.3 (p=0.207)
Q3: Using a virtual room to perform a nutritional interview will: (All n=76, Diet n= 24)			
A: improve skills needed in a practical dietetic care process (Yes/No)	All: 44 (58.0%) Diet: 18 (75.0%)	All: 37 (49.0%) Diet: 15 (62.5%)	-9.0%(p=0.26) -12.5% (p=0.35)
B: improve my prepared for a future job as a dietician (Yes/No)	All: 46 (61.0%) Diet: 15 (62.5%)	All: 39 (51.0%) Diet: 15 (62.5%)	-10.0% (p=0.25) - no change
C: increase my skills (Yes/No)	All: 46 (60.5%) Diet: 16 (66.7%)	All: 37 (48.7%) Diet: 11 (45.8%)	-11.8% (p=0.14) -20.9% (p=0.146)
D: lead me to learn in an innovative way (Yes/No)	All: 51 (67.1%) Diet: 18 (75.0%)	All: 38 (50.0%) Diet: 16 (66.7%)	-17.0% (p=0.020) -8.3% (p=0.525)
E: bring me other benefits (Yes/No)	All: 19 (25.0%) Diet: 8 (33.3%)	All: 10 (13.2%) Diet: 7 (29.2%)	-11.8% (p=0.030) -4.1% (p=0.755)
F: No benefits (post survey only) (Yes/No)	-	All: 16 (21.1%) Diet: 3 (12.5%)	-
Post survey questions added later in pilot			
Q4 Has your participation increased your level of awareness related to harmonisation of DCP in Europe? (Yes/No) (All n=59, Diet n=9)	All Yes= 20 (33.9%), No: 7 (11.9%), N/A: 32 (54.2%) Diet: Yes = 5 (55.6%), No= 2 (22.2%), N/A = 2 (22.2%)		
Q5: Has your participation improved your interpersonal skills or coaching capacity to benefit your future work or current professional practice. (Yes/No) (All n=59, Diet n=9)	All: Yes= 22 (37.0%), No= 6 (10.2%), N/A =31 (52.5%) Diet: Yes= 3 (33.3%), No=1 (11.1%), N/A = 5 (55.6%)		
Q6: After today's interaction have you increased your awareness of a healthy habit (Yes/No) (All n=59, Com n=50)	All: Yes = 43 (73.0%), No= 16 (27.1%) Com: Yes= 35 (70.0%) , No = 15 (30.0%)		
Q7: After today's interaction could you start a new healthy habit related to your diet? (Yes/No) (All n=59, Com n=50)	All: Yes= 42 (71.0%), No = 17 (28.8%) Com: Yes = 36 (72.0%), No = 14 (28.0%) -		

Expected Benefits and Outcomes

In Question 3 Participants were asked to select what benefits they expected to receive from using the platform. Unfortunately, the results showed a decrease in perceived benefits for all answers in the final survey, though only the question on innovation was statistically significant for the whole cohort, and non-significant for the student/teacher subgroup. Feedback from some students indicated that they did not really perceive any advantage to the virtual clinic over using existing teleconferencing software like Zoom or Microsoft Teams which would explain the lower scores on innovation. The overall decrease in expected/perceived benefits (Figure 19) warrants further investigation and highlights the importance of integrating the platform into the dietetic curriculum in a structured manner with specific learning objectives and outcomes, which was lacking during the piloting phase.

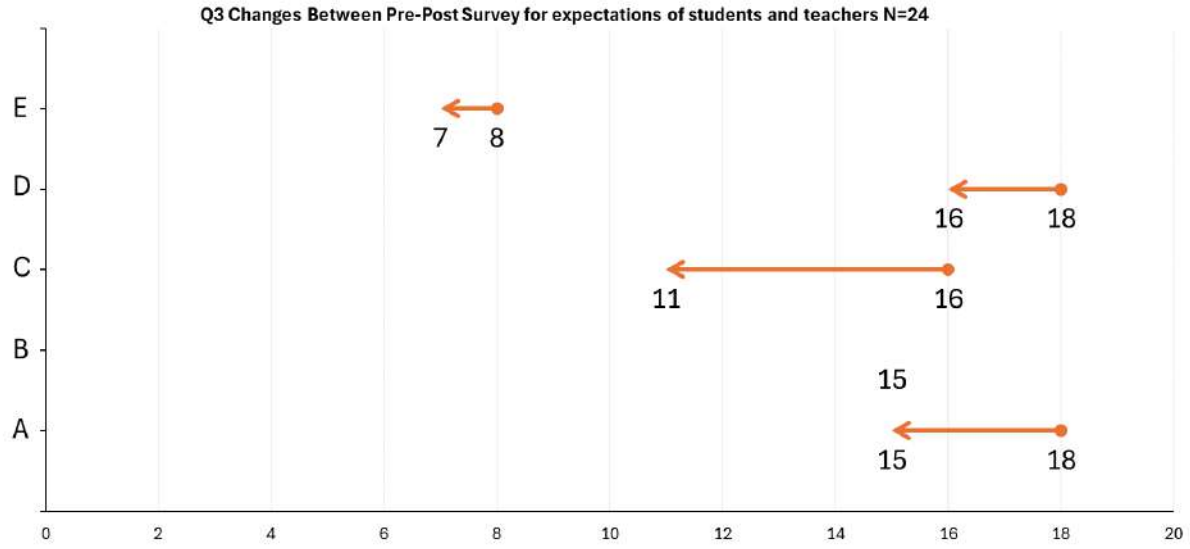

Figure 19: Changes between initial and final survey responses for expected and perceived benefits from the student/teacher subgroup

Awareness of DCP and Interpersonal and Coaching Skills

Question 4 asked participants if their involvement in the pilot increased their awareness of the harmonised dietetic care process. While all participants were asked this is only relevant to those in education (students/teachers). this subgroup is only made up of 9 participants due to the late addition of this question to pilot and lower rates of responses due to technical issues in accessing the final survey making it difficult to elucidate useful information. Just over half of participants indicated that there was an increase in awareness. For question 5, investigating improvements in coaching and interpersonal skills, the positive response rate was just over 30%. The small sample size makes it very difficult to draw any conclusions for this data and it may not be representative, for example, and independently collected data set from FH Sankt Pölten of 28 student participants indicated that 89.3% agreed that the clinic would increase interpersonal skills and coaching capacity.

However, key improvements may include development of accompanying materials about the DCP as part of the platform, and specific exercises targeting coaching and interpersonal skills being integrated into classroom activity recommendations.

Healthy Habits

Questions 6 and 7 asked participants if they increased their awareness of and were able to start a new healthy habit after the interaction. This question was asked of all participants but targeted to the community participants. Unfortunately, this question was added later in the piloting process meaning that only 50 community participants answered. The healthy habit questions related to piloting activities that involved giving participants some general healthy eating advice, the delivery of this advice differed between partner institutions. Overall, 70% of community participants indicated they had increased awareness of a new healthy habit and 72% said they planned to start a healthy habit related to their diet. While this result is positive and indicates that the community engagement aspect of the project could have beneficial health outcomes, future implementations would benefit from more consistency in delivery of intervention activities and data collection.

Lessons Learned

The piloting activities for the service learning/trainers tool revealed several important insights into the platform's strengths and areas for improvement. First, the variation in piloting methods across partner institutions, while providing flexibility, led to inconsistent implementation and outcomes. The lack of standardized integration into the curriculum resulted in participants having neutral to slightly positive opinions on the platform's usefulness and effectiveness, with little change between the pre- and post-surveys. The perceived benefits of the platform decreased after use, with students noting that existing teleconferencing tools like Zoom or Microsoft Teams provided similar functionalities, particularly in terms of innovation. Additionally, technical issues such as low response rates in the post-surveys and the late addition of key questions made it difficult to draw robust conclusions about the platform's impact on participants' awareness of the Dietetic Care Process (DCP) and their interpersonal skills.

Despite these challenges, the platform showed potential for engaging community members in adopting healthy habits. Around 70% of community participants indicated that the platform increased their awareness of healthy habits, and 72% expressed intent to start a new healthy habit, demonstrating the tool's potential in promoting public health. However, the lack of consistency in delivering these interventions and data collection across partner institutions limited the ability to fully assess the platform's impact.

Recommendations

To enhance the service learning/trainers tool's effectiveness and overall implementation, several key recommendations are proposed. First, future rollouts should prioritize integrating the platform into the dietetic curriculum with clear learning objectives and structured activities that align with specific educational outcomes. This would ensure a more consistent and effective use of the platform across partner institutions. Second, the platform's perceived benefits and innovation should be improved by distinguishing its features from existing teleconferencing tools. Incorporating more advanced functionalities tailored specifically to dietetics education, such as built-in clinical scenarios, specialized dietetic assessments, and guided role-play exercises, could better align the platform with users' needs.

To address technical and content gaps, providing comprehensive materials on the Dietetic Care Process and developing exercises focused on interpersonal skills would be valuable additions. Additionally, consistency in delivering interventions targeting healthy habits should be prioritized, along with standardized data collection processes to better evaluate the platform's impact. Addressing technical issues, such as improving access to post-surveys and resolving response-rate challenges, will be critical for gathering meaningful data in future implementations. These enhancements will help realize the full potential of the service learning/trainers tool for both educational and community health purposes. Finally, as the full features of the platform are realised, with the addition of AI supported data transformation to create new chatbots, users perceptions may change and should be reevaluated at that time.

4.3.2 Feedback from Partners

Following the piloting activities, project partners were asked to give feedback written or in meetings to their experiences with the platform including which student groups participated in piloting, additional feedback collected locally, observations and opinions on the piloting process, and suggested improvements. The result of that feedback is in the following section. Table 4 provides an overview of the piloting activities undertaken at each partner institution.

Table 4: Piloting activities by partners for the Service Learning platform

Institution	Description of piloting activities	Number
UNEAT	Students/interns participated in community outreach program and provided basic dietary advice to real patients under supervision.	100 patients signed up, 44 completed
AP University	Tested in 25 1:1 video consultations and one larger group session. Students spoke to healthy people and explained basics of healthy eating.	49 participants
University of Porto	Not yet piloted	N/A
FH Sankt Pölten	Bachelor Dietetics Students, Semester 1 (Communicating for health and nutrition - English)-students made short presentations on healthy habits and recommendations for behaviour change to other students acting in the role of community members.	28 student participants
UJK	Not yet piloted	N/A
UvA	Not yet piloted	N/A

There was large heterogeneity in piloting activities and processes. There were also a number of barriers to piloting including difficulty incorporating the platform into existing classes, participant institutions being unsure about security of patient data and therefore reluctance to use with real patients, some institutions do

not have any online classes and cannot require students to participate in activities that fall outside the regular class structure, pilot program not fitting to local standards and practices. Nonetheless, the piloting that has been performed so far has revealed useful information that can be used to improve the integration of the tool in the future.

Additional Piloting and future planned activities

Several partner institutions have not yet started pilot activities or they are ongoing at the time of this report. For example FH Sankt Pölten will implement the tool in a student project group in Winter Semester 2024/25 which will pilot the tool with real community members.

The platform has also been shared by partners on social media and with teaching staff.

Impact on participants with fewer opportunities

One of the targets of the project is to reach 390 participants with fewer opportunities over the course of all project activities. This includes people with geographical, health, economic, social or migrant background obstacles. While reach to this group was not directly measured partners were asked to give feedback on how their piloting activities supported access by these groups. For the service-learning tools the target is primarily students and community members. Partners noted that the online availability of the tool meant students and community members did not need to travel to receive the nutritional advice, as they would for a traditional consult setting, which helps meet needs of people with geographical or health barriers. UNEAT in particular were able to access populations in Santander, other regions of Spain and Latin America. Telehealth tools like the virtual clinic have the potential to overcome many barriers to equitable health access. In future, more targeted campaigns to vulnerable groups could be realised and accompanying learning and education materials developed as a supplement to the platform.

Climate change

One of the additional targets of the project is to help combat climate change. Partners perceived that reduction in travel and emissions, as well as conveying healthy eating advice with a focus on sustainable food systems helps to address this target.

4.3.2.1 Partner Specific Feedback

UNEAT

Description of Activities:

- From April 2024 UNEAT implemented a community outreach program with dietetic interns. To access the community a QR code was created a shared on social media and through the universities own communication channels.
- The pilot involved patient booking appointments with dietetic students interns who conducted a basic dietetic interview and provided general dietary advice which was supervised by professors.

Feedback:

- Provides a good simulation of real clinical environment and students were very interested in using the clinic.
- Technical: was not possible to see appointments made by other dietitians/students
- User interface, and technical experience was very good

- Reasonably relevant and easy to integrate in existing education program as there is an existing external practice.

AP University of Applied Sciences

Description of Activities:

- There were 25 1:1 (max 3 people per session) consults organised and one large group session totalling 47 participants.
- Students spoke to healthy people and explained basics of healthy eating.
- Students receive a certificate of participation upon completion as evidence of professional development activity.

Feedback:

- Positive feedback was that the sessions could be completed remotely and saved time
- It was identified that the pre and post surveys are not targeted to each user group i.e. patients get the same questions as student dietitians
- For the dietitian/student it takes a lot of time to schedule consults and guidance/ a manual is needed
- There are lots of email notifications from the clinic which is frustrating for both the patient and dietitian.
- Technical: delay between dietitian starting a consult room and system letting the patient in.
- User interface and experience and technical performance rated as poor. And seen as not very relevant to the curriculum.

FH Sankt Pölten

Description of Activities:

- Piloting involved semester 4 bachelor dietetics students in classes on dietetic consultations in English.
- Students were sent detailed instructions on how to register and book appointments in the clinic.
- Students had to create a presentation on a specific healthy habit/behaviour change and present it on the online platform to a small group of other students in the role of patients.
- Students were graded on their presentation as part of the class.
- Additional feedback was collected from students verbally in class and in a separate online form.

Feedback:

- 89.3% students reported that using the virtual clinic increased interpersonal skills and coaching capacity
- Students reported registering and booking consult sessions was easy
- Many students did not see an advantage of using the platform over other existing solutions such as Zoom or Microsoft teams, but did see advantages overall for telehealth consults.
- Students thought that giving the patient the ability to share their screen or send documents would be useful, such as pictures of foods, labels, medical information.
- Many students reported that the final survey did not appear after finishing their appointment.
- From the partners/teaching point of view it was difficult to integrate the platform into the existing curriculum and much more time and structured documentation is needed before piloting with real patients. There are concerns around data security that must be clearly addressed.

Other feedback

Partners who did not yet pilot generally reported difficulty in integrating the platform into existing classes/curriculum. Some partners have no possibility to conduct online classes or set work outside of the classroom making use of the virtual platform limited. It is also technically, and legally difficult to integrate real patients into the piloting process at this early point in the piloting.

4.3.2.2 Common insights

Through synthesis of the partners experiences in piloting there are some common themes that provide valuable insight into the piloting process, its successes and areas for improvement.

Heterogeneity in Piloting Approaches

The piloting activities across institutions varied significantly, reflecting differences in course structures, available resources, and institutional readiness. Some partners were able to integrate the platform smoothly into existing curricula, while others struggled due to challenges like the inability to hold online classes or limitations in working with real patients.

Relevance to Educational Programs

Feedback on the platform's relevance to existing curricula was mixed. Institutions that already had external practice components, like UNEAT, found it easier to incorporate the platform into their programs. In contrast, others, like FH Sankt Pölten and AP University, reported challenges in fitting the tool into their curriculum and expressed a need for more structured guidance, resources, and support.

Technical and User Experience Challenges

Common technical issues included delays in starting video sessions, an overwhelming number of email notifications, and problems with accessing the final survey. Feedback from participants indicated a desire for greater customization options, such as the ability for patients to share documents or screen content during consultations. Partners also identified the need for more targeted pre- and post-surveys based on user roles (e.g., dietitians vs. patients), improved onboarding documentation, and better alignment with specific course objectives.

Limited Perceived Advantages Over Existing Solutions

Many students and teachers did not see a clear benefit in using the platform compared to other commonly available solutions like Zoom, especially for basic tasks such as teleconferencing and group sessions. However, there was acknowledgment that the platform's telehealth focus could be advantageous if further refined and targeted toward dietetic practice. One aspect that was not addressed by any participants or partners is the extended use of the platform in using patient interviews to generate new chatbots for the self-learning platform. This is an area which may need to be further highlighted to HEI institutions and explained as a point of differentiation.

Data Security and Legal Concerns

Across institutions, there were consistent concerns regarding the security of patient data and the legal implications of using real patients in a pilot setting. These concerns hindered broader adoption and

participation in the piloting process, suggesting that clear guidelines and assurances are essential before further rollouts.

Lessons Learned

The piloting of the service learning and virtual clinic platform highlighted significant variability in implementation across partner institutions due to differences in curriculum structure and the ability to use real patients, pointing to a need for adaptable and guided integration strategies. Technical challenges along with concerns about data security, were recurring themes, underscoring the importance of optimizing functionality, user experience and data security. While the platform's potential for telehealth and community outreach was recognized, particularly in reducing barriers for underserved populations, its perceived advantages over existing tools like Zoom were limited. Moving forward, targeted improvements in technical reliability, user interface design, and support resources are essential to enhancing the platform's relevance and effectiveness in both educational and clinical settings

Recommendations

1. Standardized Integration and Structured Support: Future iterations should focus on developing comprehensive implementation guidelines that are adaptable across diverse curricula. These guidelines should include detailed instructions, case studies, and resources that make it easier for institutions to integrate the platform into their existing educational frameworks.
2. User Interface and Technical Optimization: Simplifying scheduling processes, reducing notification overload, and resolving delays in video session management should be prioritized. The platform should also incorporate features such as screen sharing and file uploads for the patient users.
3. Enhanced Data Security and Legal Compliance: Clear, standardized data security protocols and legal guidelines should be developed and communicated to all partners. This would address concerns related to patient data protection and make institutions more comfortable engaging with real patients during piloting.
4. Targeted Engagement for Underserved Populations: The platform's potential to reach participants with fewer opportunities should be maximized through targeted outreach campaigns and partnerships with organizations serving underserved communities. Additionally, developing educational materials that accompany the platform could enhance its accessibility and impact.
5. Continuous Feedback and Iterative Improvement: Regularly collecting and acting on user feedback will be crucial for ongoing improvements. Implementing an iterative development process that incorporates user suggestions, such as more intuitive workflows and better process flow adaptations, will ensure that the platform remains relevant and user-friendly.

By addressing these common insights and recommendations, the service learning platform can become a more effective tool for both educational and community health purposes.

4.3.3 Feedback from Technicians

Technical Challenges during piloting

- Reported Issues: Enumerate any relevant technical issues encountered during the pilot phase.
    - Users experienced intermittent disconnections during video conferences, affecting the continuity of clinical consultations.
    - There were inconsistencies in appointment scheduling, with some users unable to book available slots.
    - The extraction of intents and responses was inaccurate in some cases, affecting the quality of the chatbot-generated responses.
    - There were difficulties in starting and maintaining video conference sessions when the number of participants exceeded 10.
    - Concerns were raised about the protection of patients' sensitive personal data.
- Resolution Strategies: What strategies were employed to resolve these issues?
    - Adjustments in the BBB server configuration and network optimization to improve connection stability.
    - Updating the plugin to the latest version and reviewing customizations to ensure compatibility.
    - Re-adjustment and re-training of Dialogflow and ChatGPT models, improving natural language processing algorithms.
    - Adjustments in the BBB server configuration to optimize resource usage and improve video conference load management.
    - Implementation of HTTPS using SSL/TLS to encrypt all communications between users and the platform.
    - Strict configuration of roles and permissions to ensure that only authorized personnel can access sensitive information.
    - Use of Google Cloud Monitoring to supervise server performance and receive alerts for potential issues.
    - Daily backups with a retention period of up to 14 days to ensure data recoverability in case of failures.
- Outstanding Technical Challenges:
    - Optimize resource management to minimize costs while maintaining responsiveness on demand.
    - Ensure platform compatibility with new versions of APIs and services such as Dialogflow and ChatGPT.
    - Ensure continuous compliance with global and local regulations in a changing regulatory environment.
    - Optimize the user interface for more intuitive and user-friendly navigation.

User Experience

- User Feedback
  - **Video Conferences:** Users reported high-quality video conferences with clear audio and smooth video when load conditions were not extreme.
  - **Appointment Scheduling Tool:** The tool was considered efficient and easy to use, allowing users to book and manage their appointments without complications.
  - **Interface Customization:** Users expressed interest in allowing greater customization of the interface to better adapt the platform to their individual preferences and needs, enhancing their overall experience and satisfaction.
  - **Guides and Tutorials:** Users requested more guides and tutorials to help them navigate and effectively use all the platform's functionalities.
  - **Process Flow Adaptation:** Users suggested adapting the user process flow to meet the specific needs of each clinic.
- Suggestions for Technical Improvement to improve user experience
  - **Server Capacity and Configuration:** Users suggested improving the capacity and configuration of BigBlueButton servers to better handle sessions with many participants and reduce disconnections.
  - **Responsive Design:** Improve the platform's responsive design to ensure a better experience on mobile devices and tablets.
  - **Workflow Optimization:** Implement adjustments based on user feedback to simplify and optimize workflows, improving operational efficiency and user satisfaction.

Additional Technical Insights

- **Scalability:** The infrastructure based on Google Cloud offers high scalability, allowing for dynamic adjustment of server resources according to the clinic's needs. This flexibility is crucial for handling unexpected load spikes and ensuring consistent performance.
- **Adaptability of Moodle and BigBlueButton:** Moodle and BigBlueButton are highly adaptable platforms, enabling the rapid implementation of new features and customizations. This ensures that the virtual clinic can evolve and respond to the changing demands of the healthcare sector.
- **Regulatory Compliance:** The platform is designed to comply with international regulations such as GDPR and HIPAA, ensuring the protection of sensitive personal data.
- **Performance Optimization:** Through continuous optimization of server and database configurations, the platform maintains fast load times and efficient performance, even under high loads. Improvements to the BigBlueButton infrastructure have reduced disconnections and enhanced the quality of video conferences.
- **Ongoing Evolution:** While many initial issues have been resolved, the platform must continue evolving to address remaining challenges such as scalability under extreme loads and the continuous integration of new technologies.

- **User Process Flow and Responsive Design:** Adapting user process flows according to the specific needs of each clinic and improving the responsive design are key areas requiring ongoing attention to maintain the platform's relevance and efficiency.

Lessons Learned

The piloting phase revealed several critical technical challenges and user experience insights that are essential for improving the service learning/trainers tool. Intermittent disconnections during video conferences and inconsistencies in appointment scheduling were key issues affecting the platform's reliability, as well as difficulties in maintaining video conference sessions with more than 10 participants, highlighted areas requiring further technical optimization. Additionally, concerns about protecting sensitive patient data underscored the importance of strict security measures. Despite these challenges, resolution strategies such as server optimizations, plugin updates, and improved security protocols were effective in addressing many issues. However, outstanding challenges, including resource management, ensuring compatibility with evolving APIs, and enhancing the user interface, remain.

User feedback was generally positive regarding video and audio quality during stable conditions and the ease of use of the appointment scheduling tool. However, users expressed a desire for greater interface customization, more comprehensive guides and tutorials, and better adaptation of workflows to specific clinic needs. These suggestions highlight the need for continued technical improvements and a more user-centred design.

Recommendations

To improve the platform's performance and user experience, several key recommendations are proposed. First, increasing the capacity and configuration of BigBlueButton servers is critical to reducing disconnections and ensuring stable video conference sessions, particularly when handling larger groups. Optimizing the platform's responsive design will enhance the user experience across all devices, especially mobile and tablets. Implementing workflow adjustments based on user feedback will also improve operational efficiency and satisfaction.

Further, ongoing efforts should focus on enhancing resource management to maintain cost-effectiveness while ensuring platform responsiveness. Regular updates are necessary to maintain compatibility with new APIs and services, while the platform must continually adapt to comply with changing global and local regulations. Expanding interface customization options, providing more detailed guides and tutorials, and tailoring user process flows to clinic-specific needs will increase user satisfaction and platform usability.

Additionally, leveraging the scalability of Google Cloud and the adaptability of Moodle and BigBlueButton will be crucial as the platform evolves. Continuous performance optimization, particularly under high loads, and addressing remaining technical challenges such as extreme load scalability and seamless integration of new technologies, will ensure the platform remains effective and relevant. Maintaining a proactive approach to platform development and responding to user feedback will be key to the platform's long-term success in both educational and clinical environments.

5. Summary

The E+Dieting_Lab project serves as a forward-thinking initiative aimed at enhancing dietetics education through the integration of innovative digital tools. Two core platforms were developed to address various educational needs: the self-learning tool and the service-learning tool. The self-learning tool leverages virtual patient chatbots designed to simulate real-life clinical scenarios, allowing students to practice patient history taking and improve their diagnostic skills in a controlled environment. On the other hand, the service-learning platform provides a virtual clinic for telehealth interactions, enabling students to engage in supervised consultations with real or simulated patients. Both platforms aim to bridge gaps in dietetics education by offering immersive, interactive experiences that build practical skills, enhance interpersonal communication, and develop digital competencies essential in modern healthcare settings.

These tools were piloted across several partner institutions during 11 months, each facing unique challenges and opportunities. Overall, both piloting activities demonstrated significant positive outcomes, particularly in enhancing digital literacy and some practical skills among dietetics students. The self-learning tool effectively introduced students to virtual patient interactions, improving their familiarity with chatbot technology and providing a structured environment for practicing dietary consultations. Despite some significant limitations, students appreciated the tool's ability to reinforce foundational skills and offer feedback, which is crucial in undergraduate education. Meanwhile, the service-learning tool showed strong potential for real-world telehealth applications, offering students the opportunity to engage in simulated clinical consultations, develop interpersonal skills, and apply their knowledge in a supervised setting. Across both tools, participants valued the flexibility to learn and practice remotely, making these platforms accessible to a wider audience, including underserved communities. Additionally, the online nature of the tools aligns with sustainable practices by reducing travel and promoting digital learning. These positive aspects underscore the potential of these innovative platforms to modernize dietetics education and support more equitable access to health services.

The piloting process also revealed significant variability in implementation due to differences in curricula, resource availability, and institutional readiness. While some institutions smoothly integrated these tools into their existing frameworks, others struggled with issues such as data security concerns, the relevance of the tools to their specific educational needs, and difficulties in engaging students and community.
Key lessons learned include the need for better alignment of these digital tools with local educational standards and practices, improved user interfaces, and enhanced integration of advanced AI technologies to create more dynamic and realistic interactions, making necessary to develop recommendations addressed to trainers, managing boards but also to professional associations and policy makers. The technical challenges encountered such as browser compatibility issues, and the limitations of chatbot responses, underscore the importance of ongoing optimization and support.

In summary, while the piloting activities demonstrated the potential of the E+Dieting_Lab tools to enhance dietetics education, they also highlighted areas for refinement. Recommendations include more structured guidance for integration into curricula, enhancements in user experience, and the development of targeted resources to support both educators and students. By addressing these challenges, the project can better

fulfil its objective of preparing future dietitians for effective professional practice in a rapidly evolving healthcare landscape.

6. References

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7. Appendices

Appendix 1: Pre- and Post survey questions from the self-learning tool

1. Have you ever used a chatbot?
2. My knowledge about the use of a chatbot in the learning proves by dietetics students is at (1-5: Very Bad- Bery Good)
3. My Skills in using a chatbot in the learning process as a dietetics student are at (1-5: Very Bad- Very Good)
4. Please Evaluate your knowledge and skills on how to use a chatbot as a complement- self learning tool in your learning process (1-5: Very Bad- Very Good)
5. What do you expect from using a chatbot as a self-learning tool by dietetics students?
    a. To improve skills needed in a practical dietetic care process
    b. To be better prepared for a future job as a dietitian
    c. To increase self-learning skills
    d. To learn in an innovative way
    e. Other (please specify)
6. What is your opinion about the effectiveness of using a chatbot as a self-learning tool for dietetics students? (1-5: not at all effective – highly effective)
7. Evaluate the usefulness of using a chatbot as a self-learning tool by dietetics students to increase competence in diagnosis and work with a patient (1-5: not at all useful – extremely useful)
8. If you would like to add any comments or have any concerns about using a chatbot as a self-learning tool by dietetics students, please write them here.

Post Survey only

9. Practical knowledge with clinical or communication dietetics is updated (Yes/No)
10. New training tools improve classroom practice in dietetics (Yes/No)
11. My Capacity related to interpersonal skills are increased (Yes/No)
12. Has your participation increased your level of awareness related to harmonisation of DCP in Europe? (Yes/No)
13. Has your participation improved your interpersonal skills or coaching capacity to benefit your future work or current professional practice? (Yes/No)

Appendix 2: Collection of Partners Feedback on Piloting Self-Learning Tool

Data was collected from partners via google forms or interview

1. Partner Institution
2. Description of Piloting Activities: Please provide details of piloting activities including type and number of participants, class types (semester, degree program etc if applicable), how piloting was implemented, number of session/classes etc.
3. Description of other training activities
4. Description of any planned training/piloting activities
5. Please detail how piloting activities reached vulnerable population groups
6. How many vulnerable participants took part in piloting (if known)
7. How did piloting activities support the objective to combat climate change?

   Additional Data collected during piloting: If you collected any additional information during piloting such as feedback forms, comments from participants etc
8. Type of data collected
9. Methods of data collection: Description of how data was collected from participants. e.g. online survey provided to students, notes from comments made during piloting, discussions with colleagues etc.
10. Summary of Data Findings
11. Observations not captured by structured data

    Personal Feedback on Chatbot Functionality and Experience
12. User Interface and Experience (1-5: Very Poor- Very Good)
13. Reliability Chatbot platform (Response time, able to access, working for all participants) (1-5: Very Unreliable- Very Reliable)
14. Ease of integration into education program (1-5: Very Easy- Very Difficult)
15. Relevance of chatbot to curriculum (1-5: Irrelevant – very relevant)

    Feedback to Specific Aspects of the Chatbot Tool
16. Registration and Login
17. Patient Cases
18. Self-Assessment Questions
19. Feedback provided to participants

    Applicability of Chatbot in dietetic education
20. Please describe how your institution plans to use the chatbot as a teaching tool
21. Suggestions for future applications of the chatbot in dietetic education

    Open Ended Feedback
22. Overall Impressions
23. Identified issues and suggested solutions
24. Additional Comments or Observations

Appendix 3: Pre- and Post survey questions from the service-learning tool

1. Select your sex:
2. How did you know us? (Select university)
3. You are a (Student/Dietitian/Teacher/Other)
4. Evaluate the usefulness of using a virtual room by dietetics students to increase competence in diagnosis and work with a patient.
5. What is your opinion about the effectiveness for dietetic education of using a virtual room?
6. Using a virtual room to perform a nutritional interview will improve skills needed in a practical dietetic care process.
7. Using a virtual tool to perform a nutritional interview will improve my prepared for a future job as a dietician.
8. Using a virtual room to perform a nutritional interview will increase my skills.
9. Using a virtual room to perform a nutritional interview will lead me to learn in an innovative way.
10. Using a virtual room to perform a nutritional interview will bring me other benefits, please specify.
11. Other benefits

Post Survey only.

1. Has your participation increased your level of awareness related to harmonisation of DCP in Europe?
2. Has your participation improved your interpersonal skills or coaching capacity to benefit your future work or current professional practice.
3. After today's interaction have you increased your awareness of a healthy habit
4. After today's interaction could you start a new healthy habit related to your diet?

Appendix 4: Collection of Partners Feedback on Piloting the Service-Learning Tool

Data was collected from partners via google forms or interview

1. Partner Institution:
2. Description of Piloting Activities
3. Description of other training activities
   Description of any activities outside of insitution piloting. For example if you have presented the virtual clinic to other dietitians, or to other insitutions etc.
4. Description of any planned training/piloting activities
   Any piloting activities that have not yet been completed.
5. Please detail how piloting activities reached vulnerable population groups
6. How many vulnerable participants took part in piloting (if known)
7. How did piloting activities support the objective to combat climate change?
   Any relevant suggestions (e.g. during piloting with community sustainable food choices, virtual appointments can save patients from driving and thereby reduce emissions etc)

Additional Data collected during piloting

1. Type of Data collected:
2. Methods of Data collection
   Description of how data was collected from participants. e.g. online survey provided to participants, notes from comments made during piloting, discussions with colleagues etc.
3. Summary of Data Findings
   Please provide a summary of the findings of any additional data collected during piloting
4. Observations not captured by structured data
   Findings from the partners e.g. observations of participants during piloting, identification of specific problems or positive experiences not otherwise noted.

Personal Feedback on Virtual Clinic Functionality and Experience:

1. User Interface and Experience (likert Scale)
2. Technical Performance (e.g. connection stability, interface responsiveness) (Likert scale)
3. Ease of integration of piloting activities into education program (Likert Scale)
4. Relevance of virtual clinic to curriculum (likert Scale)

Feedback to Specific Aspects of the Virtual Clinic

1. Registration and Login
2. Scheduling Appointments
3. Video Consult

Applicability of the virtual clinic in dietetic education

1. How effectively does the virtual clinic simulate a real clinical environment for students
2. Please describe how your institution plans to use the chatbot as a teaching tool
3. Suggestions for future applications of the chatbot in dietetic education
4. In what other contexts could you envision the virtual clinic being used (apart from what was done during piloting)

Open-Ended Feeback

1. Overall Impressions
2. Challenges encountered during pilot and proposed solutions
3. Feedback on engagement of students, educators and community with virtual clinic.
4. Additional Comments or Observations