

Technical Note

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Developing One Health capacity and networks through virtual training

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Abstract

The Food and Agriculture Organization of the United Nations (FAO) Virtual Learning Centers (VLCs) deliver online tutored courses with the aim of developing field capacity to integrate wildlife and ecosystem elements to approach One Health challenges. These courses also aim to create networks of professionals under the One Health umbrella. These courses cater to professionals from a variety of organizations and with a wide range of expertise, including animal health, public health, wildlife and natural resource management. The courses combine self-directed interactive modules with virtual workshops focusing on problem-based learning case studies (PBLs). Additionally, participants are encouraged to participate in an online asynchronous discussion forum. Each course is delivered for multiple countries within a FAO region and is tailored to cover specific One Health topic areas. Once the topic area



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is defined, subject matter experts and the regional VLC build the training activities by developing course-specific PBLs and selecting up to five self-directed modules that introduce concepts related to those PBLs from the course catalog of training materials. The development of the training materials and the delivery of each course involves a multidisciplinary team of professionals from different countries and backgrounds. The course was piloted for the Pacific Islands in 2021 and then run for other regions such as Southern Africa and Eastern Africa. In the future, this training activity could also be delivered in a blended format, combining virtual learning with face-to-face workshops.

Keywords: Capacity building, distance learning, continuous professional development

INTRODUCTION

In 2022, the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the World Organisation for Animal Health (WOAH, founded as OIE), and the World Health Organisation (WHO) formed the Quadripartite aiming to achieve health sustainability through the One Health approach. The quadripartite's advisory group, the One Health High-Level Expert Panel (OLEPP), considers Capacity Building one of the 4 Cs that are essential to implement One Health, together with Communication, Coordination and Collaboration^[1]. Track 1 of the One Health Joint Plan of Action (2022-2026) is dedicated to enhancing One Health capacities to strengthen health systems, including “*workforce development in all relevant sectors*”^[2].

In order to improve One Health capacities and to enhance intersectoral collaboration, it is essential that stakeholders have access to training, so they can acquire the necessary skills and knowledge to effectively carry out relevant tasks and achieve set One Health objectives. This has been encouraged and supported by WOAH and WHO, with a particular focus on the human-animal interface^[3]. Nevertheless, the One Health Joint Plan of Action recognizes that a healthy environment is also key to reducing disease transmission at the animal-human-ecosystem interface. However, overall, the consideration of the environment sector in One Health initiatives is quite recent. In fact, the incorporation of the UNEP into the Tripartite to establish a Quadripartite alliance occurred only in March 2022^[4]. Furthermore, One Health interdisciplinary training in areas such as veterinary education is still in its early stages^[5].

Online learning has been shown to be an effective training solution for professionals from health-related sectors. Advantages over more traditional methods can include enhanced learning experience, enabling learners to complete training around work or family commitments, and overcoming geographical barriers to learning. Online learning has also been useful as a tool for building collaboration in interdisciplinary and/or interprofessional teams^[6,7].

FAO Virtual Learning Centers (VLCs) (<https://virtual-learning-center.fao.org/>) are virtual hubs that design and deliver online training aiming to improve One Health capacities, including the ability to work effectively in interdisciplinary teams, in all the FAO regions. The VLCs follow a decentralized model that allows scaling up of the delivery of courses while closely considering the local contexts and training needs. There are seven VLCs providing training to countries under different FAO regions or subregions^[8], namely (1) Latin America and the Caribbean; (2) Southern Africa; (3) Asia and the Pacific; (4) Near East and North Africa; (5) Europe and Central Asia; (6) Eastern Africa; and (7) West Africa. The VLCs are coordinated from FAO Headquarters to ensure the implementation of standardized quality procedures and the effective use of resources.

The aim of this manuscript is to describe the methodology followed to implement virtual courses on One Health for a variety of professionals and assess their strengths and weaknesses in order to guide similar future initiatives.

THE VLCS ONE HEALTH COURSES

Course description

The VLCs One Health courses were designed with the overall aim of developing field capacity to integrate wildlife and ecosystem elements to approach One Health challenges. The target audience of the courses is professionals from a variety of organizations with a broad range of expertise, including animal health, public health, wildlife and natural resource management. The role of participants within their organizations can vary from course to course, depending on the defined learning objectives. When a new version of the course is announced, professionals from multiple countries within a FAO region or subregion are invited to register. Depending on the course and its objectives, the recruitment of participants is done through a nomination process by the organizations where they work, through a self-registration link or a combination of both.

VLCs courses are provided free of charge and take place over a three to four-week period during which participants study a range of self-directed materials developed with the software Storyline 360, from Articulate 360^[9], combined with taking part in live online events. The learning activities are spread over the whole period, so that trainees dedicate a maximum of three to four hours to study per week, allowing them to combine the course with other professional and personal activities. The usual overall structure is as follows: (a) One hour-long opening and closing live webinars to set up the scene and wrap up the course, respectively; (b) Up to five 30-min- to one-hour-long self-directed interactive online modules to introduce One Health concepts related to the specific topic/s to be addressed in the virtual workshops; (c) Two virtual workshops lasting from two to 2.5 h, where facilitated discussion to solve one or more PBLs takes place; (d) A discussion forum where trainees can interact with experts and other trainees to clarify doubts and share opinions and experiences; (e) A final 30 to 45 min summative assessment consisting of a computer marked multiple-choice quiz. Those completing the modules, participating in the webinars and virtual workshops (where applicable) and obtaining a passing grade in the multiple-choice assessment receive a certificate of participation.

While the self-directed modules present general concepts and have been developed to be relevant for any country, the webinars and the PBLs are tailored to cover specific topics, ensuring the course is appropriate to the participant's context. Trainers are available during the running of the course to facilitate the live events and interact with trainees through the asynchronous discussion forum.

The first course was launched as a pilot in November 2021 by the VLC for Asia and the Pacific for the Pacific countries. A total of 113 participants from nine Pacific Island countries, from animal and public health and environment sectors, registered. The course ran for four weeks, and the learning activities considered the specific priorities, challenges, ecosystems, and the main stakeholders involved in the Pacific region. As of August 2023, five VLCs One Health courses have been delivered, and two additional courses are planned for the last trimester of 2023 [Table 1].

Course development

The design of the course, with initial self-directed online modules, aimed to develop learner's knowledge. Building on this, the subsequent PBL aimed for trainees to apply their newly acquired knowledge to practical situations. PBLs are designed following the approach of "flipped classroom", as there is evidence that this format of learning can increase motivation and engagement^[10].

Table 1. List of One Health courses delivered as of August 2023

Course name	VLC	Dates	Enrolled	Logged in	Completed from logged N (%)
One Health course for the Pacific (Part I)	Asia and the Pacific	November 2021	113	70	30 (43%)
One Health course for Southern Africa	Southern Africa	February 2023	282	175	123 (70%)
One Health course for Eastern Africa	Eastern Africa	April 2023	236	153	117 (76.5%)
One Health course for Zambia	Southern Africa	June 2023	716	388	239 (61.6%)
One Health course for the Pacific (Part II)	Asia and the Pacific	July 2023	53	36	-

^{*}As of 1st August 2023. The course is ongoing. VLC: Virtual Learning Center.

A key competency for One Health practitioners is the ability to work effectively in interdisciplinary teams^[11]. It has been suggested that using PBLs is an effective learning format to encourage such collaboration^[12,13]. In fact, the One Health PBLs allowed learners to practice their personal and professional skills as they worked together in transdisciplinary teams from different countries to solve the challenges presented.

Self-directed interactive modules

The VLCs One Health courses were developed as an online adaptation of previous FAO courses delivered face-to-face, which aimed at increasing awareness of zoonotic diseases at the human-wildlife-livestock interfaces and improving collaboration among sectors to tackle them. These courses largely focused on diseases of wildlife origin and integrated wildlife and ecosystem perspectives to disease prevention and control. Courses lasted five days and have been organized in China, Bangladesh and East Africa since 2012. Participants were professionals from animal health, public health, and wildlife sectors. Based on these courses' agendas and training resources, an interdisciplinary expert group identified the core theoretical content suitable to be used for interactive self-directed learning modules. These modules were developed considering that they will be studied simultaneously by a target audience with different professional backgrounds and would form part of a catalog that is available to each FAO region or subregion.

When a One Health course is going to be delivered by a VLC, a team of FAO experts working in the specific region or subregion assess the specific training needs. Based on the results of this assessment, the VLC will define the overarching learning objectives of the course and will select relevant modules and combine them with context-specific resources (i.e., webinars and PBLs), allowing the creation of tailored courses for their area. The creation of a catalog of training resources is an ongoing process, where further content can be added depending on the availability of resources and the demand from the different VLCs based on countries' needs. As of August 2023, eight modules integrate the catalog of interactive modules [Table 2].

PBLs

Once the overarching learning objectives for the course of a region or subregion have been defined, the training team is identified and recruited. This team will be composed of a minimum of four experts with different expertise to ensure trainees can be supported in all the areas covered by the learning objectives. The team will also have a balanced representation of international and local experts. Trainers can be FAO staff already working under the One Health umbrella, or experts specifically recruited for the course (from external organizations or academia). Collaborations with other organizations and projects have also been used to form the training team.

Table 2. Course catalog of self-directed interactive modules and the modules' learning objectives

Self-directed interactive modules	Learning objectives
1 One Health: An overview	By the end of the module, participants will be able to: 1.1 explain the basic definition of One Health; 1.2 list the main disease events that shaped One Health; 1.3 describe the importance of One Health; 1.4 provide an example of how One Health concept could be applied in practice; 1.5 identify One Health benefits and challenges.
2 Sources of pathogens	By the end of the module, participants will be able to: 2.1 explain the term "human-environment-wildlife-livestock interface"; 2.2 explain basic concepts related to pathogen transmission at the interface; 2.3 describe the role of food systems in pathogen transmission; 2.4 give examples of diseases that have emerged due to interactions at the interface.
3 Anthropogenic drivers of disease emergence	By the end of the module, participants will be able to: 3.1 list anthropogenic drivers of disease emergence at the human-environment-wildlife-livestock interface; 3.2 discuss how human population growth and globalization have driven disease emergence at the interface; 3.3 explain the concepts of ecosystem health and planetary health and how these are linked to disease emergence; 3.4 describe how climate change can drive emergence of disease and affect human health; 3.5 discuss the benefit of a One Health approach to understanding and mitigating disease emergence at the interface.
4 Impact of infectious diseases	By the end of the module, participants will be able to: 4.1 list the different types of impact caused by infectious diseases; 4.2 outline the methods that can be used to estimate the impact of infectious diseases; 4.3 explain the importance of information on the global burden of infectious diseases; 4.4 explain why some zoonotic diseases are considered neglected; 4.5 explain the importance of zoonotic disease prioritization.
5 Principles of risk analysis: A One Health perspective	By the end of the module, participants will be able to: 5.1 explain the purpose and the benefits of risk analysis; 5.2 describe the process of risk analysis and its different components including risk assessment, risk management, and risk communication; 5.3 explain fundamental concepts and terminology associated with risk analysis; 5.4 explain the importance of a One Health approach in risk analysis; 5.5 provide examples of risk mitigation measures, considering a One Health perspective; 5.6 describe the advantages of implementing Joint Risk Assessments (JRA) at the country level.
6 One Health approach to wildlife trade, hunting and farming	By the end of the module, participants will be able to: 6.1 describe the importance of wildlife consumption and trade and its scale at the global level; 6.2 outline the risks associated with wildlife consumption and trade; 6.3 explain the principles of sustainable wildlife management; 6.4 give examples of One Health approaches to mitigate wildlife-associated risks.
7 One Health approach to disease surveillance	7.1 describe the basic concepts of and considerations for One Health disease surveillance and population health monitoring; 7.2 explain the importance of data collection and data management for One Health integrated surveillance; 7.3 explain the limitations, gaps and advantages of One Health integrated disease surveillance; 7.4 explain the key considerations and steps in designing a One Health integrated disease surveillance plan.
8 One Health approach to outbreak investigation and control	By the end of the module, participants will be able to: 8.1 describe the main considerations and key steps to follow during an outbreak investigation; 8.2 provide examples that illustrate the importance of a One Health approach during an outbreak investigation; 8.3 describe prevention, control, and whenever possible, eradication strategies for infectious animal diseases; 8.4 provide examples of disease prevention and control strategies for wildlife.

The team of experts will develop the PBL, defining its specific learning objectives in collaboration with the VLC. The format of the PBL can vary among courses. Four PBLs were created for the initial pilot course organized in 2021 for the Pacific Islands, addressing topics of interest for this FAO subregion on animal health, plant health, and species conservation. The scenarios used covered African swine fever (ASF), Taro leaf blight (TLB), invasive alien species and keystone species, and mainly aimed to improve participants' understanding of the regional ecosystems and the importance of biodiversity and ecological services in protecting human and animal health.

The PBLs for the One Health courses in Southern Africa, Eastern Africa, Zambia and the Pacific Islands (One Health course Part II) were structured around a tabletop simulation exercise. An evolving scenario with several injects was presented to trainees during live workshops and/or in the discussion forum, depending on the course. An inject is each piece of information provided in an exercise with the aim to prompt a specific response from one or more participants^[14].

Case study: One Health course for Southern Africa

The One Health course for Southern African countries was delivered from mid-February to mid-March 2023 by the relevant VLC. Considering the training needs for the area, the specific topic for the course was “One Health approach to outbreak investigation”. Four self-directed learning modules were selected from the catalog of training resources. Additionally, a PBL was prepared for its discussion in a dedicated online forum and two virtual workshops [Figure 1].

The opportunity to register for the course was shared through the network of contacts established by an existing regional FAO One Health project. The Ministries of Agriculture, Health and the Environment of the countries in this FAO subregion provided the list of nominated trainees to attend the course. This course was offered in a two-track format to accommodate different availabilities to participate and study. Trainees could decide at the beginning of the course whether they wanted to study the shorter track comprising the four self-directed modules and two webinars, encompassing approximately two hours of study per week. Alternatively, they could register for the longer track, which added two workshops and a dedicated forum to work on the PBL and required around three and a half hours per week.

The PBL followed the structure of a tabletop simulation exercise based on an outbreak of Rift Valley fever. Working with this vector-borne zoonotic disease enabled the creation of injects and associated questions, encouraging the discussions towards collaborations among the public health, animal health and environment sectors, while focusing on the benefits and challenges of these collaborations.

Course outcomes

Two hundred and eighty-two professionals expressed an interest in joining the course through the online registration form. All of them were enrolled to a course page containing the short-track training resources. Fifty-eight of them were also enrolled to a course page with the additional resources completing the long track [Table 3].

Interaction in the discussion forum was substantial, with 529 posts and replies made (418 in the short track and 111 in the long track). This represents an average of 2.27 posts per person in the short track and 1.98 in the case of the long track. Feedback on the course was collected through a post-course online survey [Supplementary Material 1] and showed that this training initiative was overall appreciated and the topic relevant to the participants.

VLCs One Health courses: analysis and lessons learnt

The delivery of multiple One Health courses has allowed us to identify their strengths and weaknesses and incorporate lessons learnt [Figure 2].

Obtaining high completion rates can be a challenge due to multiple factors such as poor internet connectivity and lack of time to study. Improvements incorporated in the VLCs One Health courses following the pilot one, and that have most likely had an impact on the higher completion rates are: (1) making available downloadable versions of study materials from the start of the course to facilitate their

Table 3. Completion data of the One Health course for Southern Africa

	Registered	Logged in	Completed from logged N (%)
Short track			
Animal Health	129	81	56 (69.1)
Public Health	138	85	60 (70.6)
Environment Health	15	9	7 (77.8)
TOTAL	282	175	123 (70.3)
Long track			
Animal Health	25	20	18 (90)
Public Health	24	19	18 (94.7)
Environment	9	7	4 (57.1)
TOTAL	58	46	40 (87)

Number of trainees registered, accessing and completing the two tracks of the course by sector.

access off-line; (2) reducing the total study time or providing the option to study a shorter version of the course; (3) Reducing the number of live interactive activities, substituting them by asynchronous ones.

Accreditation of the courses through professional statutory bodies to provide points for continuous professional development (CPD) could be a way to improve participation. This has been done with previous VLCs courses on animal health targeting veterinarians. However, most countries have neither recognized CPD for our target professionals nor procedures for the accreditation of courses. Moreover, the attendance of trainees working in different fields would require approaching multiple statutory bodies regulating different professions, making the potential accreditation of the courses long and costly.

Another challenge to address in the future is the lower participation of professionals coming from the environmental health sector compared to the participation of those working in animal and public health. Developing courses that better address the areas of concern of these professionals could improve their interest. Carrying out an assessment to identify these areas to cover would be necessary.

Finally, it is important to understand whether trainees have improved their knowledge and/or skills through the course. To assess this, students are asked to rate their own competences targeted by the course at the beginning and at the end of the course. Moreover, information to measure the impact of the VLCs One Health courses in the daily work or professional careers of the people that attended them is collected through a survey sent between six months and one year after the end of the course [[Supplementary Material 2](#)].

CONCLUSIONS

The FAO VLCs approach for developing One Health courses enables the delivery of highly customizable versions of the same course, adapted to the specific training needs of the participating countries. The participation of a mixed audience of professionals with different expertise ensures interdisciplinarity, particularly when working through PBL case studies. Moreover, the interaction of trainees in the discussion forum facilitates the creation of international multidisciplinary networks.

Despite the multiple benefits of virtual learning, this methodology presents some limitations in replicating the most practical elements of face-to-face workshops and might be more accepted and/or accessible in some countries in comparison to others. The adaptation of the VLCs One Health course to blended formats could incorporate and combine the advantages of virtual and presentational formats.

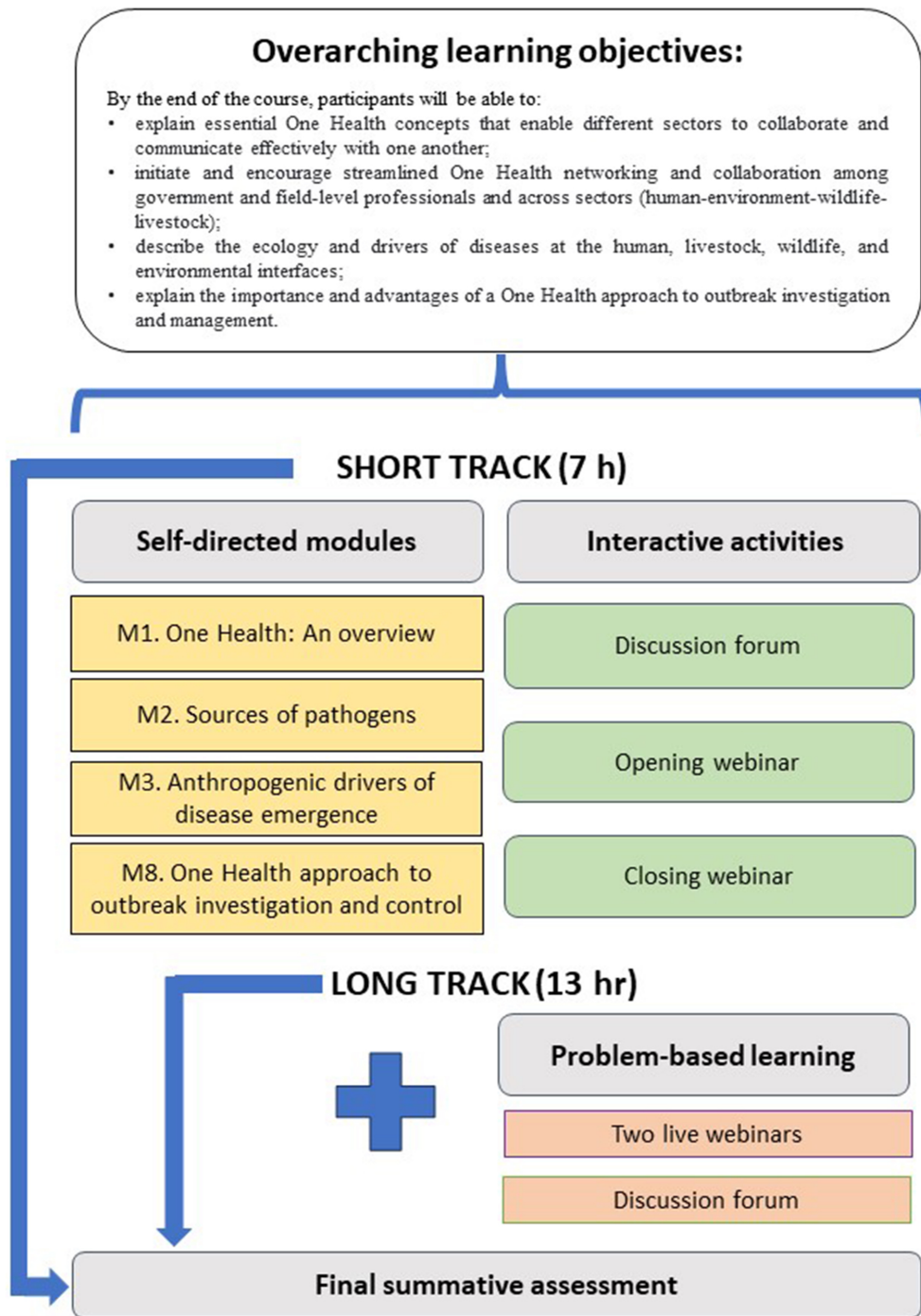


Figure 1. Scheme presenting the learning objectives, training elements and total study time for the short and long tracks of the One Health course for Southern Africa.

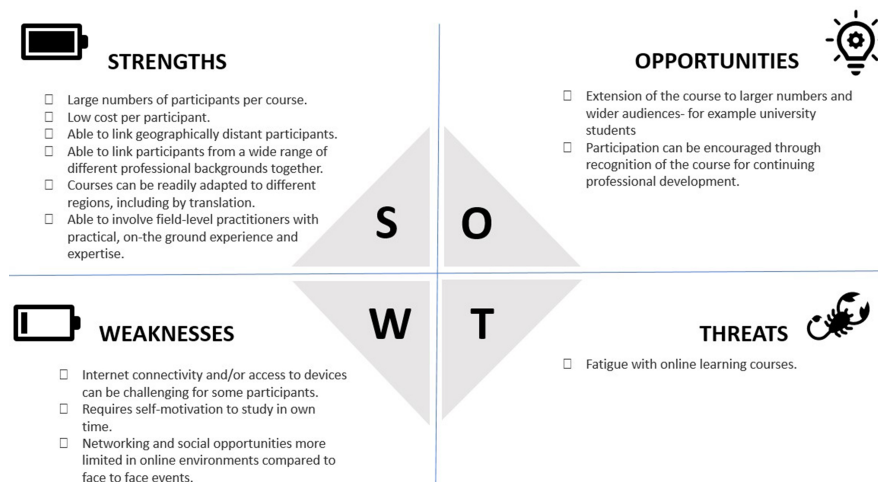


Figure 2. SWOT Analysis of the VLCs One Health courses. VLCs: Virtual Learning Centers.

DECLARATIONS

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All authors have reviewed and agreed to the published version of the manuscript.

Availability of data and materials

Not applicable.

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Conflicts of interest

All authors declared that there are no conflicts of interest. The views expressed in this publication are those of the author(s) and do not necessarily reflect the views or policies of the Food and Agriculture Organization of the United Nations.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

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