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On the bus and online: instantiating an interactive learning environment through design-based research

Ümit Kartoglu[a], James L. Vesper[b] and Thomas C. Reeves[c]

[a]World Health Organization, Geneva, Switzerland; [b]LearningPlus, Inc., Rochester, NY, USA; [c]Learning, Design, and Technology, The University of Georgia, Athens, GA, USA

ABSTRACT
The World Health Organization converted an award-winning experiential learning course that takes place on a bus traveling down the "cold chain" for time- and temperature-sensitive pharmaceutical products in Turkey to an online interactive learning environment through design-based research. Similarities and differences in the objectives of the two courses as well as the overlap in the learning activities, tools, and technologies deployed in courses are delineated. Many learning activities from the real bus course were successfully moved to the online course, but a few learning activities from the bus course could not be replicated in the online environment. However, several new and arguably more effective learning activities were implemented online that could not be accomplished on the bus. Design principles for developing online experiential learning environments were derived from the design-based research.

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Introduction

Concern for how time- and temperature-sensitive pharmaceutical products (TTSPPs) such as vaccines are stored, transported, and distributed to end users is an important challenge in the public health sector (Milstien, Kartoğlu, & Zaffran, 2006). To help ensure that TTSPPs are not subject to temperature and handling abuse, a "cold chain" is designed and implemented as an integrated system of equipment (e.g. insulated shipping containers and refrigerated trucks), procedures, records, and activities used to handle, store, transport, distribute, and monitor TTSPPs (Afsar & Kartoğlu, 2006). The reference to a chain is appropriate because, as with a physical chain, a cold chain is only as strong as its weakest link.

People are a critical element of a cold chain. For example, air cargo personnel must not leave TTSPP containers on a hot tarmac, health center managers should identify the potential risks to their storage facilities when power fails and there is no automatic back-up generator, and pharmacists are required to communicate to their clients how to take special care when they take temperature-sensitive products home. All those involved in transportation and distribution of TTSPPs must know how to take appropriate actions in the event of a problem. Establishing and maintaining a cold chain for TTSPPs is especially challenging in developing countries where incidents such as power failures and transportation breakdowns are commonplace.

For over a decade, the World Health Organization (WHO) has met these challenges by offering a unique experiential learning course focused on helping public health professionals develop enhanced knowledge, skills, attitudes, and habits focused on the management of a cold chain

CONTACT Ümit Kartoglu kartogluu@who.int World Health Organization, Department of Essential Medicines and Health Products, 20 Avenue Appia, 1211 Geneva 27, Switzerland

system for TTSPPs such as vaccines (Vesper, Kartoğlu, Bishara, & Reeves, 2010). The "Pharmaceutical Cold Chain Management on Wheels" course involves learners and mentors physically traveling by bus down the length of the cold chain in Turkey. During this bus trip, learners make direct observations at the storage, distribution, and health care delivery facilities that they visit. Throughout the six-day course, guided observation exercises take place at the visited facilities under the supervision of three mentors. Participants are provided with guidance notes, tools, and coaching to support their critical observations and their interactions with operational staff and management at these facilities. Presentations and group discussions about the observations take place on the bus, in restaurants, and in open-air venues after the visits to the facilities. Turkey was selected as the location for this unique experiential learning environment because the cold chain management system for TTSPPs there is one of the best in the world. Videos about the WHO "bus course" can be viewed online at Vimeo EPELA site (https://vimeo.com/51505482 and https://vimeo.com/131813073).

Research goal and methods

Design-based research ideally begins with the identification of a serious problem relevant to practitioners (McKenney & Reeves, 2012). The problem of moving the "bus course" online was driven by the fact that budgetary and logistical issues meant that the physical course could only be offered once annually and could only accommodate 12–15 learners per year, whereas there are hundreds of public health professionals around the world who could benefit from this unique learning experience. A design-based research study guided the conceptualization, design, development, and implementation of an online version of the bus course (Vesper, 2014). Specifically, mixed-methods research strategies (Johnson, Onwuegbuzie, & Turner, 2007) encompassing multiple iterations of expert review, risk assessment, field testing, and other formative evaluation strategies were utilized (Vesper, Herrington, Kartoğlu, & Reeves, 2015; Vesper, Kartoğlu, Herrington, & Reeves, 2015).

As described by Vesper, Herrington, et al. (2015), a design-based research initiative focused on developing an online Pharmaceutical Cold Chain Management course began in September 2010 with the identification of initial design principles based upon the authentic tasks e-learning model developed by Herrington, Reeves, and Oliver (2010). The beta version of the course was first offered in March 2013 through a new platform EPELA (Extentio et Progressio, Authentic e-Learning), designed by the e-learning development team. The course has been offered regularly ever since. The rest of this paper describes how the objectives and features of the physical "bus course" and the online version overlap and differ. The paper concludes with a discussion of three design principles derived from the design-based research process that may be useful to others interested in converting an in-person experiential learning environment into a virtual one.

Analysis of two delivery modes

The bus course and the online course have a great deal in common, but there are important differences. In some cases, these differences are to the advantage of the learners on the physical bus and in other cases the differences are arguably beneficial to the online learners. As illustrated in Figure 1, the objectives of the two versions of the course are similar, but the objectives in the online course are more specific compared to those of the bus course mainly due to nature of the more precisely pre-defined tasks in the online course.

By contrast, the objectives in the bus course are intentionally less defined in advance in order to allow what is seen and discussed during the facility visits and discussions to help inform the objectives actually addressed during the six-day bus course. In this regard, the bus course may be viewed as somewhat more unpredictable and spontaneous, requiring great flexibility on the part of the mentors who must decide on the spot whether an issue or problem observed at a specific site should be the focus of more intensive analysis and discussion. Though the same facilities are often visited during the annual bus course in Turkey, the experiences of the learners differ from

Objective	Bus course	Online course
Define 25 basic terms important in handling time and temperature sensitive pharmaceutical products.		Online 1
Identify the major operational components in a pharmaceutical cold chain	Bus 1	
Illustrate the inputs, activities, and outputs of each operational component of a pharmaceutical cold chain	Bus 2	
Given a situation, propose recommendations to improve compliance with "good distribution practice" (GDP) guidelines.	Bus 3	Online 2
Given a cold storage facility, assess and control the risks to pharma, biopharma, and vaccine products consistent with GDP and "good storage practice" (GSP) guidelines	Bus 4	
Given a non-conformance in the transport of pharmaceutical product, analyse data to identify the cause, potential impact to the product, and formulate preventive measures.		Online 3
Given a list of elements that could be in a quality agreement, justify five elements you consider to be most beneficial.	Bus 5	Online 4
Given an example of an operational component in a pharmaceutical cold chain, differentiate the practices as to whether or not they reduce risks.		Online 5
Given a situation, select the appropriate methods and materials for packaging and shipping cold chain products to minimize risk	Bus 6	
Given a mode of transportation, identify hazards, and assess and identify methods to control the risks to pharma, biopharma, and vaccine products that are consistent with GDP.	Bus 7	Online 6
Given a cold chain operation, evaluate which risks require a contingency plan in line with GDP/GSP.		Online 7
Given a stock situation with different vaccines, various expiry periods and batches and VVM status, decide which products to be dispatched against a requisition order.		Online 8
Create a decision tree for dispatch of vaccines involving all relevant factors.		Online 9
Develop an action plan for the successful implementation of a policy change in in-country vaccine distribution.		Online 10
Conduct a risk assessment for a given risk question related to temperature monitoring of temperature-sensitive pharmaceutical products in a storage facility.		Online 11
Given a mode of distribution in the last mile, assess and control the risks to pharma, biopharma, and vaccine products consistent with GDP.	Bus 8	Online 12
Assess and control the risks to pharma, biopharma, and vaccine products in a given power cut situation.		Online 13
Given a list of risks and control options, prioritize which risks to reduce first.		Online 14
Compare the advantages and disadvantages of a min-max thermometer to other temperature monitoring devices used in the last mile.		Online 15
Given a situation, select the appropriate methods and materials to monitor temperature and/or humidity for cold chain products to obtain necessary data for making decisions	Bus 9	
Given a specific temperature monitoring strategy, assess and control the risks to pharma, biopharma, and vaccine products consistent with GDP/GSP	Bus 10	
Examine and assess documents and records that support a cold-chain process consistent with GDP/GSP	Bus 11	
Identify work practices that contribute or reduce risks to a cold-chain worker's health and safety	Bus 12	
Given a video of someone performing a shake test, evaluate the process followed, the results obtained, and justify whether the vials can be used.		Online 16
Conduct a shake test to decide whether a given freeze-sensitive vaccine has been affected by freezing.	Bus 13	Online 17
Create a report on the results of a shake test.		Online 18
Given two different scenarios of temperature exposure, expiry date, VVM status and opened/unopened multi dose vials, judge whether the vaccines are suitable for use.		Online 19
Given a client, conduct critical analysis of the cold chain management system and make recommendations to improve the performance of the system in line with GDP/GSPs.		Online 20

Figure 1. Comparison of 13 objectives in bus course and 20 objectives in online course.

year to year depending on the new processes introduced in the facilities as well as any corrective actions introduced after previous visits. A hallmark of the bus course is that each site visited receives a report from the learners and mentors summarizing their observations and, when deemed

necessary, providing a list of recommended actions to reduce or eliminate any problems or risks observed at the site.

As seen in Figure 1, there are 13 pre-specified learning objectives for the bus course, and 20 for the online course. Five of the objectives are common to both courses. One of the reasons for seven additional objectives in the online course is that each of the realistic scenarios in the online course has been specified in advance of the course offering, and therefore these objectives are known to be addressed within these scenarios. Although there are 13 pre-specified objectives for each offering of the real-world bus course, more objectives are often added based upon the issues found at the actual sites visited during the bus trip.

Perhaps the most important advantage of the online course over the bus course is evident in the last objective listed in Figure 1: "Given a client, conduct critical analysis of the cold chain management system and make recommendations to improve the performance of the system in line with good distribution practices/good storage practices." The online course lasts 12 weeks with an expectation that learners will engage with the course activities 6–12 hours per week. For the first seven weeks, the learners make virtual visits to various facilities, and at each site, they encounter and tackle realistic problems, working individually in a few cases, but more often collaborating in small groups. By contrast, the final five weeks of the online course involve a complex and highly authentic real-world task. During this time, small groups of participants collaborate to analyze the immunization program and the handling of TTSPPs (e.g. vaccines) of a real country such as Albania, based on reports the country and WHO provide, other documents freely available on the Internet, and specific information provided when requested by the participants from the manager of the country's immunization program. Participating countries (or regions within larger countries) receive a concrete benefit from this activity in the form of detailed recommendations for improving their cold chain for TTSPPs in that country. At the same time, the learners themselves extend their expertise in managing a cold chain and as a bonus perceive the value of experiencing online collaboration in the face of complex, challenging, authentic tasks.

In addition to differences in objectives, the learning activities, tools, and technologies deployed in the bus course and online course differ to a degree as illustrated in Figure 2. The "Packing Challenge" is an example of an activity that is very supportive of learning in the bus course, but not available within the online course. On the first morning of the bus course, learners are divided into groups of two or three, and challenged to pack some actual vaccines for transportation over the next three days. Each group receives one of six different packaging technologies and they must collaboratively work out a loading pattern to protect vaccines at 2–8°C for 72 hours along the journey. In addition to the vaccines, they are given different types of temperature monitoring devices to include in their packages. These packages are exposed to various stress conditions when the bus stops for a rest break or a meal (such as exposing them to direct sunlight) to simulate potential hazards that could occur to TTSPPs in real life. At the end of 72 hours, group members open their packages and present their findings both on the performance of the packaging technology based on their observations and the results from temperature monitoring devices. A plenary discussion of these observations takes place during the very last day of the course. There is no comparable packaging activity to this in the design of the online course.

However, a hands-on real-world activity that takes places in both courses is the "Shake Test" (Kartoğlu, Özgüler, Wolfson, & Kurzatkowski, 2010), a method of determining if a freeze-sensitive vaccine has not been frozen and can be used. In the bus course, the Shake Test is demonstrated to the learners on day 3 and then they have an opportunity to practice it with real vials of vaccine (and each participant keeps these three vials they practiced with). In the online course, three vaccine vials are couriered to each participant. At WHO Headquarters in Geneva, all vials have been specially labeled, with one vial frozen and identified as the "negative control". Two other vials are "unknowns". The package sent to the participants includes one vial that has been frozen and one that has not. The task in the Shake Test is for the participant to determine which of the unknowns has not been frozen, and therefore, would be safe and effective to use in an immunization program. (Though they are real

Description	Bus course	Online course
Pre-course survey for participants	A 10-question survey is sent to all participants to evaluate their expectations and match them with course objectives to come to a verbal agreement during the introduction session on Day 1.	A 12-question survey is sent to all participants to evaluate their e-learning experiences.
Pre-course survey for supervisors	A 7-question survey is sent to all supervisors to evaluate the supervisor support for the participant both before and after the course.	A 7-question survey is sent to all supervisors to evaluate the supervisor support for the participant both before and after the course.
Emails	Emails are mainly used for communicating acceptance, sharing reading documents and links to videos that need to be watched prior to their attendance to the course.	Emails are mainly used for communicating acceptance, technical requirements, guidance throughout the course, reminding about task details and deadlines, sharing mentor's observations in summary format following each task. At individual level, the course director also communicates via email with participants regarding their diary entries.
Icebreaker	An icebreaker activity is introduced at the very start of the bus course for everyone to get to know each other better.	No icebreaker activity
Introduction	Introduction session covers expectations and objectives, programme and the journey. During the expectations and objectives, we summarize the results of the pre-course questionnaire and how they match with course objectives. Through this, we explain which expectations will not be covered during the course and reach a verbal agreement on the objectives of the course. Details of the workflow and how we would be working during facility visits are explained and discussed during programme and journey. Two sessions on QRM (quality risk management) and vaccine packaging are run by mentors to explain basics in both fields.	An introductory WebEx conference is organized prior to the course, attended by all mentors and participants. We explain the workflow and what is expected from participants and what would they expect for mentors. We also answer all questions coming from participants.
Pre-course question-naire	A questionnaire with 33 true/false statements is given to all participants to provide an overview of the contents before starting the course and stimulating their thinking about the cold chain subject areas. Responses are collected anonymously to mark them in a matrix to understand the "group's" performance to help mentors to make final touches to the programme.	No pre-course questionnaire. However, an individual task "The big picture: Who am I?" is given as the first task as a self-assessment for the commonly used 36 terms from the course.
Packaging challenge	Six different packaging technologies are assigned to groups for them to work out a loading pattern to protect vaccines at defined temperature range for 72 hours along the journey. They also include different type temperature monitoring devices to compare the advantages and disadvantages in monitoring temperatures. These packages are exposed to some stress conditions during the stopovers (such as exposing them to direct sunlight) to simulate potential risks that could happen in real life. Packages are opened by participants at the end of 72 hours and groups present their findings both on the performance of the packaging technology and the temperature monitoring devices. A plenary discussion takes place on the very last day of the course.	None.
Scavenger hunt	Participants are given a list of 14 conditions and are requested to seek and take a photograph of each item as specified. The game is introduced for sharpening the observational skills as well as improving the understanding of the specific concepts through different interpretations. One photograph in each category in digital format are submitted to course management by participants and presented at the plenary on the last day of the course followed by a discussion. Participants also vote for the best photograph and a prize is given.	Participants are given a list of 15 conditions and are requested to seek and take a photograph of each item as specified. The game is introduced for sharpening the observational skills as well as improving the understanding of the specific concepts through different interpretations. There is no limit of number of photographs to be submitted. All works are uploaded directly by the participants to scavenger hunt blog site established by the course organizers. Participants are requested to explain the story behind each photograph they post.
Facility visits	Participants always work in groups during the facility visits. They focus on two major areas: cold storage as well as packaging and dispatch. Following a	Virtual facility visits are arranged through "facility tour" videos as well as 360-degree spherical photographs from each facility. In each facility, there

Figure 2. Comparison of activities, tools, and technologies used in bus and online courses.

vaccine vials, these test vials are marked "not for human use" since they are specifically intended for learning purposes). Participants document their identification evidence with photos and upload their reports to Google Drive for the course mentors to give feedback.

	presentation by the facility, participants are taken to a facility tour and then they break in groups to work. In their task, participants use quality risk management approach to analyse the operations.	are defined tasks, some individual and some group work. Specific areas addressed during the authentic tasks include GDP inspections, temperature excursion, quality agreements, risk treatment, contingency plan, Vaccine Vial Monitors, introduction of cool water packs, handling prescriptions ate retail pharmacy, power cut, and shake test.
Reporting back	Participants work in open areas en route; mentors assist groups to guide them whenever necessary. Following presentations to the group, mentors facilitate the discussion on issues raised by the group. The mentor summarizes the important findings relating them to the theoretical backgrounds.	Participants work in Google Drive for both individual and group tasks. Once the reports are submitted, they peer-review other reports and comment on other individuals' and groups' work. Mentors give detail feedback to each paper online within 24 hours of the submissions. Mentors also prepare a paper to summarize the observations, challenges and recommendations on each task.
Video and document libraries	Selected videos and documents are shared with participants prior to the course to prepare them for the work ahead during the course. Depending on the need, additional videos are shared during the bus course.	All participants have access to video and document libraries and directed to specific videos/documents for each task.
Learning diary	Not applicable	Participants are required to create a learning diary, specifically at the end of each virtual visit and during their final project, they are asked to consider what they have learned, what specifically they are going to take back to work and use and comments, suggestions and ideas to course managers. In these diaries participants also reflect on what has worked and what has not worked during the authentic tasks and how would they do it if they face a similar situation. All diaries are read by mentors and feedback is provided via email on an individual basis.
Shake test	All participants receive three vials of DT vaccine (one control vials and two test vials) and conduct the shake test following a demonstration by the mentor.	All participants receive three vials of DT vaccine during the course, and they conduct the shake test, document with photographs and share their experiences in Google Drive folders.
Discussion forum	Extended discussions take place following group presentations. Topics vary depending on the subjects raised by the groups. If fewer points are raised by participants, mentors raise issues for further discussion.	An online discussion forum is used mainly by participants raising questions and commenting on the posts of others. Mentors intervene either to summarize the discussion or when an expert view is requested.
Mid-course questionnaire	A multiple-choice questionnaire containing 30 questions is given to participants on Day 4 afternoon and they are asked to write their names. The main objective of this questionnaire is for mentors to meet with each and every participant before they leave the course and discuss the answers provided by them. This allows a detailed review of subjects covered during the course. The whole idea is for all to come to same understanding regarding certain subject areas.	Not applicable
Final assignment	Not applicable	Following seven weeks of virtual visits, participants in teams are requested to work as consultants for a client to evaluate the country's time and temperature sensitive supply chain evaluations. They prepare and present their work to the country officials via a WebEx video conference followed by a discussion.
Participants performance evaluation and certification	All participants who attend all sessions of the course receive a "participation" certificate. Their performance is evaluated through mentors' observations during facility visits, group work, presentations, discussions and scavenger hunt photographs. Facilitators meet on a daily basis to evaluate the day's activities as well as discussing participants' performance and decide on an action plan if necessary to involve some participants more in coming days.	There are no pen-paper tests in the form of true/false or multiple-choice in this course. Authentic assessment is used wherein the assessment is integrated with the task, rather than in the form of a separate test. Authentic assessment is designed to focus on completion of a real world task and does not hold any individual's work up against the work of others. In other words, authentic assessment identifies strengths and weaknesses with respect to the nature of the task, but does not compare or rank learners. Simple attendance in this authentic e-learning program does not qualify all participants to receive a certificate. In addition to authentic assessment performed within the tasks, to receive a "successful completion" certificate, learners must at a minimum:

Figure 2. Continued.

The learning diary incorporated in the online version is a very supportive tool to promote learning, but it is not available within the bus course. At the end of each virtual visit and following the final project, participants are asked to pause and reflect on what they have learned in this particular

		- Complete all tasks - Comment on work of other participants and groups - Participate in discussions raised in Discussion Forum by mentors or by other participants - Start a discussion in Discussion Forum - Participate in Scavenger Hunt - Write in the diary for each facility visit and the real country case
Letter to myself	At the end of the course, participants are requested to write a letter to themselves (in their local language if they wish) as a reminder for the things they are planning to implement within three months of their return back to their work. These letters are sealed and collected back and mailed to participants in three months by the course management.	Not applicable
Course evaluation	Course evaluation is done through a written form containing eight questions, mostly open-ended and with two questions with ranking. The results are compiled and shared with the whole group via email. Following written evaluation, all participants and mentors are asked to reflect on the week's work and in turn they all speak to explain their feelings. These sessions are recorded and edited (shortened) version is released publicly through Vimeo.	Course evaluation is done through a WebEx meeting with participation of all participants and mentors.

Figure 2. Continued.

section, what are the things they are going to take back and use in their work settings, and what would they do differently if they face similar problems next time. This allows them to return to the experience by recollecting the salient features of the experience and attending to feelings by accommodating both positive and negative feelings about the experience. It also allows them to re-evaluate the experience by associating the new knowledge and integrating it into their conceptual framework. Reflecting on learning experience through the learning diary is critical in the whole learning process (Kolb & Fry, 1975; Schön, 1987). Participants' diaries are periodically read (only) by mentors and feedback is provided on a one-on-one basis.

Design principles emerging from the design-based research

Moving a unique experiential learning environment like the bus course into an online environment was a formidable task that was accomplished through design-based research. Design-based research generally has two major outcomes, a robust innovation and a set of design principles that can be applied in future development projects (McKenney & Reeves, 2012). The online bus course as a robust innovation is one major outcome of the project. The WHO is now able to offer the online Pharmaceutical Cold Chain Management course several times a year, greatly expanding the number of learners from all around the world who can enhance and expand their knowledge and skills in this critical area.

The other major outcome of the design-based research is a set of design principles that others may be able to use in future efforts to instantiate authentic experiential learning online. The full range of reusable design principles is reported by Vesper (2014), but three of the most important ones are highlighted below.

Design principle 1: rather than perfectly duplicate, replicate where possible and innovate where necessary

Trying to duplicate, clone, or "mirror" an existing course into one that uses a different delivery system or technology is like trying to force a square block into a round hole. Different delivery methods – putting participants in a bus or positioning them in front of a computer connected to the Internet – demand that designers and mentors understand the strengths and weaknesses of each delivery

mode and maximize the strengths and delimit the weaknesses of each environment. Several participants in the educational design research project were able to participate in both the physical bus course and the online bus course. One such participant said:

> [The e-learning course is] not just like the real bus course but different. What I found even better than the bus course, if you spoke a foreign language, you could rewind [the video] and listen 2–3 times … That was a big advantage of the e-learning.

Another participant who was enrolled in both versions of the course spoke of the affordances provided by the use of shared documents placed on the Google Drive site available to all the participants, a technology not available in the physical version of the course:

> We have the chance to go back to Google Documents and see our group's work and other groups and then, if we have some comments, we can add something more.

Yet another participant who completed both versions of the course pointed out how the online resources contributed to his learning:

> The visit experience during actual course of the bus was real due to one [on] one interaction with Farmalojistik team and mentors. But frankly I am gaining more through e-learning. Thanks to rich knowledge bank in the form of library documents and videos.

When designing an online version of a physical experiential learning environment, emphasis should be placed on taking advantage of what the technology allows the learners to do, rather than just copying a learning activity that was intended for use using a different delivery mode. For example, the online course affords learners, supported by their mentors, to engage in reflection and meta-cognition over time by keeping a course diary, whereas the bus course is so intensive that such reflection does not necessarily occur until after the learners have returned to their home countries.

Design principle 2: the collaboration that is essential to instantiating authentic tasks-based learning strategies online is a new experience for most learners and must be carefully nurtured

Most of the tasks in the online course required collaboration, such as selecting the most important elements of a quality agreement, preparing a contingency plan to reduce risk, creating a project plan for a major change in handling vaccines, conducting an analysis, and writing a report on vaccine storage and handling practices in a selected country such as Albania. Some of these collaborative interactions were relatively short as participants took only a few hours to complete them. However, the final task was much more complex and time consuming, requiring many hours over weeks. These tasks each had two types of outcomes: the tangible and the intangible. The first outcome was a tangible artifact – the contingency plan or the report, for example. The second outcome was the intangible value of negotiating with other team members, working together – sometimes more successfully than others – and the mental construction of the various elements that formed that final artifact. Online learners from diverse cultures need considerable scaffolding to successfully complete the tasks while also becoming better and better collaborators (Oh & Reeves, 2015). This is a major challenge that requires continuous monitoring and support on the part of the online course mentors.

Design principle 3: the fidelity of the simulated experiential learning environment does not have to be exceptionally high as long as it enables learners to suspend disbelief and feel that what they are experiencing is real

When the participants in the bus course enter cold (2–8°C) or freezer (−25°C) rooms at a regional pharmaceutical storage facility in Turkey, there is no doubt that a person is experiencing an authentic

environment. In the online course, this physical condition is impossible to replicate, requiring some degree of suspension of disbelief to be enabled on the part of the learners (Herrington, Oliver, & Reeves, 2003). Humans commonly suspend disbelief when reading a good book or watching a great film, in many cases literally becoming engrossed in the experience. The challenge of getting learners in the online course to suspend disbelief was difficult for many reasons. For example, there is usually a great range of previous expertise among the learners in the online course, and thus the same authentic activity that may perceived as unrealistically easy for some learners may be perceived as unrealistically difficult for others.

Technology plays a role in fostering suspension of disbelief just as special effects do in an action film. One participant in the online course commented at the end on how the facility tour videos and 360° photos of the sites visited contributed to her sense of being there:

> The videos – the facilities tour – you almost feel like walking with the camera. This is something that makes the course so lively.

Technology and its affordances can contribute substantially to an online course and the learner's suspension of disbelief and ultimate engagement in the course. But technology is not enough. Mentors must treat their learners less like students and more like fellow professionals collaborating to accomplish important authentic tasks.

Conclusion

At this time, both the bus and the online Pharmaceutical Cold Chain Management courses are offered, but neither is a static entity. The managers of these learning environments at the WHO view them as living laboratories for the extension of research and development focused on enhancing learning opportunities for public health personnel around the globe. Already, the lessons learned in this project are being applied to the development of new courses at the WHO. Readers who wish to review some of these courses are invited to visit this site: http://www.epela.net/epela_web/.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Ümit Kartoglu is a medical doctor and a scientist at the World Health Organization Headquarters in Geneva. He began his career in Turkey, where he served at all levels of the national health system for over 10 years. He joined UNICEF in 1994 and has been with the WHO since 2001. He brought to life the WHO-UNICEF Effective Vaccine Store Management initiative; Global Training Network for Vaccine Management; and the Performance, Quality and Safety project. Ümit coordinates the Global Learning Opportunities network, and has developed a variety of courses, tools and games for learning, receiving numerous international awards for his work.

James L. Vesper is a consultant to pharmaceutical and biopharmaceutical manufacturers on Good Manufacturing Practices, providing learning course design and technical expertise through LearningPlus (Rochester, NY). He has worked as a consultant/advisor on a variety of WHO projects since 2009. Much of his current work relates to quality risk management, investigations of failures, preventing contamination in drugs, and improving human performance. His work has been published in five books, and numerous technical publications. He received his Ph.D. from Murdoch University (Perth, Western Australia) and his M.P.H. from University of Michigan School of Public Health (Ann Arbor, MI, USA).

Thomas C. Reeves is Professor Emeritus of Learning, Design, and Technology in the College of Education at The University of Georgia. He earned his Ph.D. at Syracuse University. He was Fulbright Lecturer in Peru and an invited speaker in the USA and more than 30 other countries. His books include Interactive learning systems evaluation (with John Hedberg), A guide to authentic e-Learning (with Jan Herrington and Ron Oliver), Conducting educational design research (with Susan McKenney), and MOOCs and open education around the world (with Curt Bonk, Mimi Lee, and Tom Reynolds).

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