

ON *OCCUPATIONAL HEALTH IN DEVELOPING COUNTRIES*
– A MASSIVE OPEN ONLINE COURSE



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Vår 2019

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ON OCCUPATIONAL HEALTH IN DEVELOPING COUNTRIES – A MASSIVE OPEN ONLINE COURSE

Health and safety at work is not just sound economic policy; it is a basic human right

Kofi Annan, former Secretary General of the United Nations

Higher education shall be made equally accessible to all, on the basis of capacity, by every appropriate means, and in particular by the progressive introduction of free education
United Nations' International Covenant on Economic, Social and Cultural Rights (ICESCR), Article 13, paragraph 2(c), 1966

Abstract

Introduction: Occupational injuries and diseases are estimated to cause more than 2.78 million fatalities annually, of which most occur in low- or middle-income countries (LMICs). In addition, a tremendous amount of non-fatal occupational injuries and illnesses occur worldwide each day. Knowledge of occupational safety and health is often absent or insufficient in many LMIC settings. Education is an integral part of the development of occupational safety and health systems in LMICs. The use of online resources like e.g. Massive Open Online Courses (MOOCs) is one way of reaching many, where the resources are sparse. In 2015, the University in Bergen launched the MOOC *Occupational Health in Developing Countries*. The course was explicitly aimed at sharing knowledge and experience of occupational safety and health with learners based in LMICs. *Objective:* The objective of the study is to describe the participant profiles and the participation activities of *Occupational Health in Developing Countries* learners. *Method:* The study is based on a quantitative review of data provided by the FutureLearn MOOC platform. The research design is descriptive and analytic. The introduction and contextualization are based on a review of relevant literature. *Results:* Out of totally 5866 registrants, 72.4 % attended from a LMIC geo-location, and 71.9 % of the 768 course completers were LMIC residents. Most of the participants were young, well-educated and employed; mostly within the health and social sector. The gender distribution was almost equal,

except from a higher female non-completer proportion, especially among LMIC participants. The response rates were, however, relatively low. *Conclusion:* The MOOC succeeded in reaching its LMIC target group.

Introduction

The present text is intended as an introduction to, and a contextualization of, a study on the participation profiles and the participation activities of the first edition of the University in Bergen's (UiB) Massive Open Online Course (MOOC) *Occupational Health in Developing Countries* from 2015. The text is part of a Master's thesis at the UiB, and has been created to provide a clearer and more thorough description of the background of the study than the resulting research article format permits. The text will elaborate on the MOOC phenomenon as well as on online education in low- or middle-income countries (LMICs). The LMIC definition is based on the United Nations' Country Classification.¹

The results of the study will be discussed in light of the low response rates at the course registration questionnaire, and at the pre- and post-course surveys. A critical consideration of the materials and methods applied for the study will be provided in order to suggest a strategy for further research on MOOC participation in general, and on occupational safety and health MOOC participation in LMICs in particular.

The general objective of the Master's thesis has been to obtain information on the participation of LMIC learners in the UiB's *Occupational Health in Developing Countries* MOOC. A description of the of the typical LMIC MOOC learners, including both completers and non-completers, may contribute to a better understanding and targeting of potential candidates, and hopefully to a better accommodation of the proportion of learners who struggle to complete the course. It was hypothesized that there may be differences in participation activities between LMIC and high-income country (HIC) learners, due to, and reflecting, differences in economic and material conditions, differences in the perceived working conditions, as well as differences in the existence and extent of national level occupational safety and health management systems. Specifically, the study set out to describe *Occupational Health in Developing Countries* participant characteristics with respect to gender, age, educational background, employment status and employment area, as well as geographic distribution. Participant profiles and participation activities of LMIC learners were compared to those of HIC learners. Furthermore, the participant characteristics and the participation

activities of *Occupational Health in Developing Countries* were compared with general MOOC participation data.

Occupational Health in Developing Countries

In 2015, the Department of Global Public Health and Primary Care at the University of Bergen, Norway, launched the MOOC *Occupational Health in Developing Countries* on the FutureLearn MOOC platform. The course was explicitly aimed at sharing knowledge and experience on occupational health and safety for learners based in LMICs. *Occupational Health in Developing Countries* was not only targeted at a LMIC audience, but the content of the course thematizes occupational safety and health challenges which are particularly relevant to LMICs, with articles and video clips taken from LMIC settings. The course has been developed together with Addis Ababa University in Ethiopia and Muhimbili University of Health and Allied Sciences in Tanzania by UIB professors with extensive academic experience with LMIC occupational safety and health issues. The course content, reflecting an introductory level syllabus targeted at a very large population of LMIC participants, is inevitably quite general. Perhaps due to similar reasons, the presentation of the content is also, at least from a MOOC perspective, traditional.

Occupational Health in Developing Countries managed to attract a fair portion of LMIC target group participants. Out of totally 5866 registrants, 72.4 % attended from a LMIC geo-location, and 71.9 % of the 768 course completers were LMIC residents. Proportionally there were little differences in participant profiles and participation activities between the LMIC and the HIC groups. Female participants from both groups had lower completion rates than males, and this difference was considerably higher within the LMIC group. The study supports the general profile of MOOC learners as young and educated, but, in contrast to previous findings on MOOC participation, *Occupational Health in Developing Countries* had higher female participation rates than average, especially when comparing LMIC data on MOOC participation.²⁻⁵ Being targeted at LMIC participants, *Occupational Health in Developing Countries* also had a LMIC participation rate far above the percentages reported in many other studies.²⁻⁵ In comparison, a study of 34000 participants from 32 different MOOCs offered by the University of Pennsylvania on the Coursera platform found that the majority of participants

(65.3%) were from OECD-countries.³ In a study of the first 17 courses on the edX platform, only 2.7 % were from the United Nation's list of Least Developed Countries.⁶

The ultimate purpose of *Occupational Health in Developing Countries* is the translation of theoretical knowledge into practical actions on the side of the LMIC occupational setting learners. This knowledge can be expected to be relayed and diverted on its track to action, and one possible outcome is the development of local educational programs based upon, or inspired by, the course. The course may thus contribute to educating educators as well as serving as a resource for local programs. Franco *et al* highlight that:

it is important to understand that the results of implementing MOOCs in developing countries are dependent on the learning purposes attached to them; which, in their turn, can affect the motivations and decisions of educational institutions to implement their own MOOCs.⁷

The development of MOOCs in LMICs can potentially contribute to overcome some of the technical, cultural and language barriers to participating which is experienced in many LMIC settings. Hopefully, MOOCs, like *Occupational Health in Developing Countries*, can act as a spearhead in this process, and spur the establishment of locally developed learning programs within occupational safety and health.

Potential conflicts of interests

All qualitative data on *Occupational Health in Developing Countries* participants and participation were provided by the FutureLearn platform. Quantitative background data and information on course structure and content were provided by two of the course developers and educators, who also supervised the present Master's thesis on *Occupational Health in Developing Countries*. The proximity of the data sources to the study subject can potentially be problematic, due to the risk of information being partial, selective or biased. While recognizing the potential conflicts of interest, the insights provided by the supervisors have been essential for understanding the intentions and motivations which have shaped the course, and which have driven the promotion of the course content. The qualitative input from the supervisors has also provided direction and structure for the assessment process.

Contextualization and methodological considerations

International occupational safety and health

The global burden of occupational injuries and illnesses is tremendous, both in terms of human suffering as well as in economic terms. The International Labour Organization (ILO) estimates that globally 2.78 million workers die annually from work-related injuries and diseases (2017).⁸ Out of these, 380500 deaths are estimated to be caused by occupational accidents, and 2.4 million by work-related diseases.⁸ LMIC workers comprise almost three thirds of the global workforce,⁹ but the injury and death toll in LMICs is proportionally much higher than in HICs.¹⁰ These dramatic differences may partly be attributed to the transfer of hazardous industries from HICs to LMICs during the past years, but the absent or insufficiently developed occupational safety and health management systems in many LMICs are also believed to contribute strongly to the inequalities.¹⁰ The knowledge and awareness of occupational hazards are sparse in many LMICs, and in many cases, the individual worker may not be in a position to question unhealthy and unsafe work practices.^{10,11} Initiatives like the World Health Organization's (WHO) *Worker's Health: Global Plan of Action*¹² and the International Social Security Association's (ISSA) *Vision Zero* campaign,¹³ to name a few, have contributed to setting the agenda for global occupational safety and health. Likewise, the International Commission on Occupational Health's (ICOH) dedication "to protect and promote workers' health and well-being at work throughout their working lives" has contributed to highlighting the working conditions of many LMIC workers.¹⁴ However, there still seems to be a lack of comprehensive data on occupational safety and health available to local policy makers. Furthermore, a disparity seems to exist between the perceived and actual costs of establishing a sufficient occupational safety and health program, and the potential gains of such, both to individuals, businesses and governments.¹⁵

According to the ILO, the vast majority of work-related fatalities are never reported as such, especially in regions where occupational safety and health management systems are entirely or partially absent, and the ILO figures above are thought to be conservative underestimates.¹⁰ Work-related cancer is the major cause of work-related deaths, and constitutes 32 % of the total death toll, while work-related cardiovascular disease and communicable diseases cause 23 % and 17 %, respectively.¹⁰ Occupational injuries are the

cause of 18 % of work-related fatalities.¹⁰ The distribution of occupational injuries and diseases between HICs and LMICs is, however, very uneven, with a large majority of injuries and communicable diseases occurring in LMICs. Non-communicable diseases are more common causes of work-related fatalities in developed countries.¹⁰

International agencies like the ICOH, the ISSA and the ILO are, along with national occupational safety and health agencies, working to improve work conditions globally. Standards and recommendations developed by the ILO are important references for occupational safety and health, but ILO conventions are only legally binding when ratified by the respective national governments.^{16,17} Only one third (66) of the organization's 187 member countries have ratified the Occupational Safety and Health Convention (C155), only 24 of the member countries have ratified the Employment Injury Benefits Convention (C121), and only 31 have ratified the Convention on Occupational Health Services (C161).^{16,17} A convention which is not ratified by a state, is also not integrated into the legislation of the state. In 2014, only 10 % of the population in LMICs were covered by occupational health and safety regulations.¹⁷

While occupational safety and health is considered an unaffordable luxury by many local decision makers in LMICs, competitiveness and occupational health have been statistically demonstrated to be inversely correlated; the lower the number of accidents, the higher the competitiveness, and vice versa, as illustrated in Figure 1.¹⁰

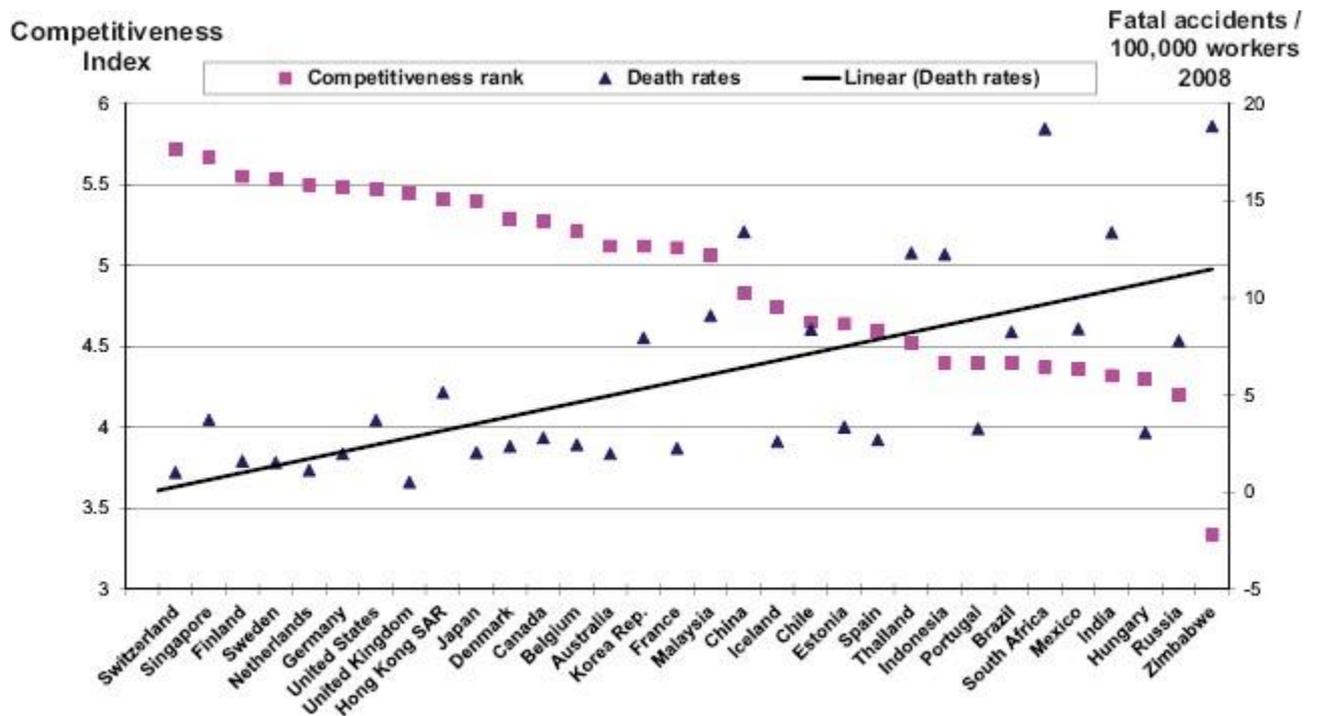


Figure 1: Inverse correlation between competitiveness and occupational safety. Source: WSH Institute and World Economic Forum Lausanne, Switzerland, 2012–2013.¹⁰

Occupational safety and health does not only provide protection of the workers by attenuating occupational risks, but can also contribute to higher productivity by reducing absenteeism, presenteeism, worker turnover and loss of experience, and, furthermore, to improve the quality of life for both the workers and their families. Conversely, socio-economic factors like illiteracy, poverty and high unemployment may compel LMIC workers to accept increasingly higher levels of risk, adding to the vulnerability caused by already unsafe and unsound working conditions.

Occupational safety and health systems in many LMICs are inadequate on multiple levels; there is a lack of trained occupational safety and health professionals, the range of available occupational safety and health services are insufficient, international occupational safety and health guidelines are incompletely adopted and ratified, and national occupational safety and health policies are incompletely implemented.^{11,17} In cases where occupational safety and health services are available, these are often limited to cover major enterprises.^{11,17} The informal sector, as well as agriculture and domestic work, which often include particularly

vulnerable workers, like children, pregnant women, and elderly are frequently not covered by any occupational safety and health program.¹¹ Migrant workers, often immigrants, are also often less likely to be protected by occupational safety and health policies.¹¹ Furthermore, as reported by the ILO, young workers are 40 % more likely to suffer work-related injury or illness, than older workers.⁹

Improvements to the current situation will require interventions on multiple levels, including more multinational corporations operating in developing countries taking accountability. The significance of multinational companies leading by example is invaluable and there have, as Deva highlights, been attempts at establishing a normative framework on occupational safety and health for transnational enterprises in LMICs (e.g. UN¹⁸), albeit with mixed success.¹⁹ A strong occupational safety and health legislation, accompanied by the allocation of sufficient resources to establish the systems required to manage such a legislation, is a fundamental requirement for protecting workers in LMICs, and for improving their working conditions. Furthermore, the education of workers, employers, occupational safety and health professionals and health care professionals is an integral part of the establishing or empowering of occupational safety and health systems in LMICs. The importance of education is also emphasized is by the WHO's *Workers' Health: Global Plan of Action*,¹² The use of online educational resources might be one way of reaching many, where the resources are sparse.

International occupational safety and health and online education

Educational programs on occupational safety and health, which are absent in many LMICs, are, however, available through international organizations like e.g. the WHO,²⁰ the ILO,²¹ the ISSA,²² the ICOH²³ and the Pan American Health Organization.²⁴ Different kinds of online educational programs, some more fragmented than others, offer effective means for a wide coverage of occupational safety and health information and high-quality educational resources.¹⁷ The use of online technologies in isolation, or integrated into blended educational strategies may potentially boost the progress of occupational safety and health education in LMICs.¹¹ Online resources, especially when available on mobile phones and tablets, may not only reach large numbers of potential learners, but may also provide a virtual meeting place for exchange of knowledge, experience, ideas and practices, and serve as a vehicle for communication and interaction with fellow professionals worldwide.¹⁷

MOOCs are internet-based, freely available educational resources, which are, in their current form, a relatively new phenomenon.^{15,25} Various forms of online educational programs have been available for decades, but the overwhelming proportion of educational resources which have been made available through the MOOC movement represent a fundamentally different and potentially disruptive educational technology.^{15,26} The MOOC movement has been characterized by a tremendous growth over a short period of time, and the courses cover a great variety of topics. The term MOOC was coined by George Siemens and Stephen Downes in 2008 for the open cyber-course *Connectivism and Connective Knowledge*.²⁷ The MOOC phenomenon took off three years later, when a course offered at Stanford University enrolled almost a quarter of a million participants.²⁸ MOOCs have since gained enormous popularity, and the numbers of participants signing up have continued to increase annually; in 2014, a total of 17 million enrolled for at least one course, and in 2015, the annual enrollment total increased to over 35 million.²⁹ However, the current and future significance of the phenomenon is still unclear, and its pedagogic, educational and financial ramifications are still subject to considerable debate and controversy.^{15,30,31} MOOCs are provided by, often prestigious, universities or other institutions, and their content is often presented by prominent teachers or experts on each particular subject or topic. The courses are offered free of charge from a number of platforms, and are available through online internet access. The massiveness of participants, often in tens or hundreds of thousands, who are making use of these resources, constitute another defining element of this form of online learning, and this is an important factor which separates MOOCs from their digital educational predecessors.

One of the necessary prerequisites for MOOC participation is internet connectivity. According to the latest estimates (2018) from the International Telecommunications Union (ITU), 51.2 % of the world's population is now with some regularity connected to the internet.³² Out of the almost 3.9 billion global internet users, almost 2.9 billion reside in LMICs.³² As the digital divide is gradually decreasing, MOOCs may become an increasingly important means of making high quality educational resources available to developing world residents.

MOOCs and learning

Most MOOCs are freely available, web-based courses, which can be accessed by signing up through one of the numerous MOOC platforms. The courses can be followed synchronously, which, in many cases, gives the participants the opportunity to interact with the educators and the other students. The courses can also be attended asynchronously and at a self-defined time, pace and sequence. Some MOOCs are more interactive than others, requiring more active participation from the learner, while others rely more on traditional on-way directed lectures and presentations. The courses are often interspersed with quizzes or assignments, giving the learners the opportunity to test their knowledge, and to reflect on, and utilize, the information provided through the course. Upon successful completion (the completion criteria vary between platforms), the learner is eligible to purchase a course certificate. Furthermore, university credits can be obtained for some courses.

The MOOC movement was, by the popular press and in scientific literature alike, initially presented as a massive hype. The phenomenon was portrayed as a digital tsunami by Stanford president John Hennessy in *The New Yorker* in 2012,³³ the same year which was coined *The Year of the MOOC* by *The New York Times*.³⁴ The hype now seems to have died down somewhat, and MOOCs are in the process of settling as one of the many tools in the educational toolbox. The first years of the MOOCs saw a significant number of studies conducted on the phenomenon, adding to, responding to, and perhaps also adding fuel to, the media hype. Both the direst and the most enthusiastic prophecies on the disruptive potential of the MOOCs have faded into the background by now, and given way to more sober considerations on the impact and future of MOOCs. The MOOC movement has both been heavily praised and criticized, often for the very same reasons.³⁵ Aspiring to be free and open to all, the true availability of MOOCs has been debated in light of the technical, cultural and language barriers encountered by many learners, especially from LMICs.^{7,15,36-38} While offering high-quality educational resources to potentially unlimited numbers of learners, the implications of the Western dominance of the form and content of the courses, have also been questioned, giving rise to accusations of cultural imperialism and educational neocolonialism.^{35,39,40} Furthermore, the actual impact of MOOCs, and their efficiency as educative tools, have been both praised and questioned,^{25,35-37} and the criteria for quality assurance of MOOCs are also still under debate.^{31,41} Freely available MOOCs have generally

been met with enthusiasm and considered a valuable addition to the already existing body of educational resources, but have at the same time, by others, been considered a threat to traditional higher education institutions.^{38,42,43,44}

The phenomenon may not have lived up to all of the initial expectations, but the relevance of the MOOC movement should also not be underestimated. The role of MOOCs for education in LMICs has also been debated, and the UNESCO has, in the 2015 *Incheon Declaration (Education 2030 - Incheon Declaration and Framework for Action - Towards inclusive and equitable quality education and lifelong learning for all*⁴²) accentuated the role of MOOCs in achieving the United Nations' Sustainable Development Goals.⁴⁵

MOOCs and occupational safety and health in LMICs

A formidable amount of literature on occupational safety and health in LMICs is available. Research has been conducted on global, regional and local domains, focusing on policies and regulations, on general and specific occupational hazards and on populations at risk, as well as on existing occupational safety and health services, programs and interventions. Much research has also been conducted on occupational exposure and work-related injuries and diseases, as well as the social and economic burden of occupational injuries and diseases. Research on work conditions in the developing world has, furthermore, resulted in authoritative publications from institutions like the WHO and the ILO. There is also a variety of online courses available on occupational safety and health issues, but few MOOCs on this topic have been published.

The body of research on MOOCs can roughly be divided into three themes: participation activity, student behavior, and course features. One of the most prevalent issues with MOOCs have centered around the low levels of course retention and completion, the latter usually around 10 %.^{6,35} Another recurrent theme has been the challenges of quality assurance and quality assessment.^{15,31,41} Furthermore, the relative status of, and the potential integration of MOOCs into traditional educational schemes has also been vigorously debated.^{15,30} MOOC research has, however, primarily focused on audiences in North America and Europe.^{36,37}

The literature on distance education of LMIC learners, on the other hand, is sparse. As phrased by one author, MOOC research in LMICs “is still in its infancy, and empirical research on MOOC usage in developing countries is even scarcer”.³⁶ UNESCO's publication *Making sense of MOOCs - A Guide for Policy-Makers in Developing Countries*

explores the potential of MOOCs, and highlights the ongoing rethinking of the contribution of higher education to economic growth and development, parallel to the globalization of markets and the emergence of knowledge societies. The authors point out that the requirement for tertiary education in emerging economies is ever increasing.¹⁵ According to UNESCO:

this is where MOOCs could serve the development needs of resource-poor countries. The scalability of the ICT infrastructure required to create and offer MOOCs makes it easier to achieve the necessary reach in a significantly shorter time compared to brick-and-mortar infrastructure and processes”.^{15(p34)}

Consequently, little research has so far been conducted to determine the participation activity and the experiences of MOOC users in LMICs. Some studies on MOOC usage in LMICs have focused on important barriers to participation, and the actual reach and impact of MOOCs in LMICs.^{7,15,37,46} Information literacy, digital literacy and language literacy are all necessary prerequisites for following a MOOC, and all of these may pose significant challenges in LMICs. Furthermore, limited internet penetration, especially in rural areas, constitute a significant challenge for MOOC engagement in LMICs. For connected areas, insufficient internet speed and stability may also be a barrier.³⁷ The available research resources on distance education on occupational health and safety targeted at LMIC learners can, however, be supported by other reports on similar attempts at transfer of knowledge and experience.^{38,47} Research on the impact of MOOCs on education in LMICs has so far been somewhat dubious, and has yielded rather contradictory results.^{7,30,35-37} Considering, however, the amount of knowledge which is being made freely available through the MOOC movement, and the number of participants of which the providers may boast, a fair portion if the challenges seem to relate to the appropriate management of the resources and potentials which the MOOC movement possesses.^{15,26}

The relevance of MOOCs

The potential for MOOCs to contribute to the democratization of education in developing countries seems obvious. The courses can manage large numbers of learners at the same time, most of them are free of charge, and they are easily available online. But, as Yang and Evans comment, MOOCs are only part of the solution:

We are just beginning to tap the potential of online learning and MOOCs in the developing world, but it's important to note that MOOCs are not a panacea. They must be part of a broader strategy to increase access to

affordable and applicable education that includes primary school development, blended learning, apprenticeships, and mentoring.^{48(p94)}

Recognizing and acknowledging the imperfections and insufficiencies of MOOCs, many authors accentuate the role of MOOCs in the LMICs as important contributors to education in want of better alternatives. Franco *et al* writes: “Arguing that MOOCs’ weakness lie in ‘the lack of instructor follow-up’ makes less sense if the local alternative is an ex-cathedra course with thousands of students, which also lacks personalized follow-up”.⁷ A similar point is formulated by Wildavsky:

MOOCs will surely need to evolve to serve students more effectively. But, the standard for new forms of higher education should not be whether they are perfect. It should be how they compare to the highly imperfect alternatives faced by many students, particularly in the world’s poorest countries.⁴³

In other words, with Boga and McGreal: “disruptive technologies”, such as MOOCs, stand a greater chance of having an impact in markets where “the alternative is nothing”.³⁸

MOOCs may, under circumstances where local educational capacities are nonexistent, weak or overwhelmed, contribute to freeing up educational resources. Furthermore, through the high numbers of participants, MOOCs can host a large arena for exchange of knowledge, experiences and influence, for professional discussions, and allow for the development of peer-networks. Blending MOOC components into a broader educational framework would also enable program leaders to supplement, modify and adapt the MOOC content to fit local cultural habits and traditions.⁴⁹ Similarly, Liyanagunawardena *et al* mention, too, the potential that MOOCs have for reaching audiences which do not have easy access to traditional education: “MOOCs have the potential to become an invaluable tool in offering education to marginalized groups in some cultures, if the other necessary conditions for participation are met”.³⁷

As indicated by UNESCO, MOOCs hold a great potential in the developing world, but the barriers to participation, not only the technical ones, but also the social, cultural and linguistic ones need to be addressed and overcome:

A national strategy is necessary for governments in developing countries to leverage the full potential of online learning and MOOCs for education and development. The generic MOOC model will need to be re-engineered to allow for a broad spectrum of approaches and contexts, accounting for diverse languages, cultures, settings, pedagogies and technologies, and it should

include possibilities for localization. Openness is not simply a matter of barriers to access related to licenses or technological aspects; it also has to do with inherent cultural, social and institutional challenges”.^{15(p34)}

MOOC users

According to Klobas *et al*, MOOC users may very roughly be categorized, according to their motivation for participating, into utilitarian and hedonic learners.^{50(p17)} Utilitarian learners participate in MOOCs in pursuit of professional or academic development, while hedonic learners participate for the fun of the learning experience, and in pursuit of personal development.^{49(p17)} The learning outcomes of MOOCs may perhaps not be measurable through traditional learning assessment methods, and in many cases, this may neither be practicable, relevant nor desirable at all. The motivation for using MOOCs may be intrinsic or extrinsic, and the uses of MOOCs are many and varied. A number of models of participation have been suggested to describe different MOOC participation activity patterns, and thereby, indirectly, to explain the low retention and completion rates compared to other higher education programs.^{30,50} Furthermore, there is a range of engagement levels within these groups, from registrants only, to course completers, with different types and degrees of participation in between.

Research on MOOC audiences has described the typical MOOC participant as a young, educated male residing in a HIC.^{6,30,35,36} In an assessment of the first 17 HarvardX and MITx courses, only 2.7 % of the participants were registered on a geo-location from the United Nations list of Least Developed.⁶ The typical registrant was male, young and educated.⁶ The report, however, revealed a great diversity in participant profiles; “The diversity of registrants resists singular profiles; registrants are notable for their differences”.⁶ Franco *et al* similarly report preexisting higher education as a characteristic of the average MOOC participant in their review of 391 MOOC users from Thailand and Mexico: “Most of the surveyed MOOC participants had at least an undergraduate degree or higher (85.9 %), and less than 1 % claimed to have had no formal education at all”.⁷ The study of *Occupational Health in Developing Countries* was able to determine the geo-location of most of the course participants, and to confirm that the course, to a large extent, succeeded in reaching its target audience. The available data, furthermore, enabled a description of the general participation activities of all course participants, as well as indications of the same by participant subgroups. Similar to

previous MOOC research, the typical *Occupational Health in Developing Countries* participant was young and well educated.²⁻⁵ *Occupational Health in Developing Countries* was also demonstrated to have a well-balanced gender representation, but the completion rates were skewed in favor of male participants. Through a thorough review of literature on MOOCs, distance learning, as well as on international occupational safety and health, the study contextualized the results, and suggested potential areas for further research.

Completion rates

In the early days of the MOOC movements, enrolment numbers of up to hundreds of thousands were not uncommon.^{28,29} Currently, the general number of MOOC participants is still increasing dramatically, but so does the number of available MOOCs, and the tendency leans apparently towards developing greater numbers of, in relative terms, small-scale, specialized MOOCs.⁶ The average MOOC completion rate is still relatively low, though; generally between 5-15 %.⁶ The total enrolment numbers for a given MOOC covers everything from individuals who merely browse the course, without taking part in any of the course activities, to full participants who complete all sections and all assessments. In between these extremes there are different levels of course engagement. As the various MOOC platforms, however, operate with different completion criteria, comparison of completion rates between MOOC platforms is a challenge. Furthermore, it is possible to complete some courses without actually registering step completion. Likewise, it is possible to complete some courses, and register step completion, without actually engaging with the content. The traditional understanding of course completion as an indicator of quality may, however, not be completely applicable for MOOCs.

The UiB's *Occupational Health in Developing Countries* had a completion rate of 13.1 % out of the total of 5866 registrants, which is very close to the overall MOOC completion average across the different MOOC platforms.⁶ The definitions of MOOC participation and completion do, however, vary somewhat.^{52,53} Completers are defined by the FutureLearn MOOC platform, from which *Occupational Health in Developing Countries* is available, as participants completing more than 50 % of the steps of a given course, as well as all the assessments. This is also a prerequisite for purchasing the course certificate. To arrive at the course completion rates, however, FutureLearn calculate the course completers not against the total number of registrants, but against the number of learners engaging in a minimum of

the course activities. Meaningful as it may be to disregard non-engaging registrants when considering completion rates, this is not compatible with the calculations of completion rates by other MOOC providers. FutureLearn CEO Simon Nelson reflects on the background for omitting non-engaging registrants when calculating completion rates:

If ever there was a tricky area in the delivery of online learning at scale, it's the analysis of meaningful data from learning platforms (...) In selecting our data pool, we've also found it more meaningful to focus on 'learners' who showed up to a course, rather than 'joiners' who initially expressed an interest in the course when it was advertised.⁵²

The difference in practices between the MOOC platforms, however, complicates comparisons, and may contribute to obscuring useful information. When considering only the 3314 participants who engaged in a minimum of the course activities in *Occupational Health in Developing Countries*, the completion rate increases to 23.1 %.

Barriers to participation

Several MOOC studies have investigated barriers to participation.^{7,35-37} Garrido and Koepke have also investigated reasons for non-participation. The most prominent reason for non-participation identified in on MOOC usage in Columbia, the Philippines and South Africa was lack of time.³⁶ For MOOC participants, the most important barriers to participation can be divided into technical influences, cultural influences and language influences.^{7,35-37} All of these barriers are considerably more prominent in the developing world. The most obvious barriers to MOOC participation relate to the technical prerequisites for attending the course in the first place. Only approximately half of the world's population has internet access,³² and the internet penetration in LMICs is unevenly distributed, leaving especially rural areas unconnected.³⁷ Liyanagunawardena *et al* write:

In developing countries, while there are often pockets with good infrastructure, usually the capital city and a few other major urban areas, many of the towns and almost all of the rural areas will have hardly any significant infrastructure (often no, unreliable, or part-time electricity supply, for example, let alone internet connectivity).³⁷

In Garrido and Koepke's study on MOOC usage in Columbia, the Philippines and South Africa, internet access was not found to be an issue, but rather internet speed and stability presented

the major technical challenges when participating in a MOOC.³⁶ Furthermore, most of the MOOC participants reported having basic or intermediate IT skills. Use of laptop or desktop was associated with higher completion and certification rates, but with mobile phones being the dominant way of accessing the internet, especially in LMICs, the fact that very few MOOCs are designed to work on mobile platforms may possibly contribute to the low completion rates.³⁶

The same point is made by Franco *et al*:

In some developing regions, it is possible that people will bypass the tendency to use internet through computers, and instead begin to capitalize on a widespread use of smartphones and mobile-related technology – MOOC platforms could largely benefit from exploring options for delivering MOOCs via smartphones.⁷

Some platforms, FutureLearn being one of them, are already offering MOOCs, like *Occupational Health in Developing Countries*, which may be accessed from smartphones.

Other important influences on MOOC participation are cultural barriers. These will potentially remain if courses continue to be developed within one dominant cultural perspective and ignore the cultural diversity of students. This can potentially have a negative impact on both the subject matter and the teaching method.³⁵ Furthermore, the educational system in some LMICs can be radically different from the cultural context of the MOOC provider. The challenges of the MOOC format should also not be underestimated, and many, not only LMIC students, experience, as Hew and Cheung report, frustration with the lack of face-to-face, peer-to-peer and student-to-instructor interaction.⁵⁴ Hew and Cheung, furthermore, report lack of support and lack of presence of others to be the most prominent reasons for why students do not complete the courses.⁵⁴ Cultural determinants, as Franco *et al* point out, such as the relations between teacher and student, may significantly influence the reception of a MOOC from a western provider.⁷ Furthermore, the scalability of MOOCs may not necessarily be beneficial in educational systems which rely heavily on collective efforts and individual feedback.⁷ In such sociocultural contexts, massive access may appear less appealing.⁷ Similarly: “Language, cultural peculiarities, familiar sets of references and local context will always be important in education”.⁷ From this perspective both the form and content of educational resources will need to be adapted to the national and regional conditions of the learners in order to have the intended impact. The same standards cannot uncritically be applied irrespective of cultural context and local habits. Cultural differences may, as Hew and Cheung accentuate, potentially also discourage participation and completion, as the cultural

heterogeneity between MOOC users are often much greater than in an ordinary classroom setting, increasing the risk of misunderstandings and conflicts.⁵⁴ Overcoming these cultural differences will, on the other hand, potentially promote cross-cultural understanding, and may provide interesting educational perspectives.⁷

Critical voices have also raised the concern that MOOCs, representing a cheap alternative to traditional studies, may pose a threat to current higher education structures in LMICs, or even impair the funding, and thus obstruct the development, of higher education institutions in LMICs.^{2,44} Concerns have, furthermore, been raised about the Western dominance of MOOCs; in the choice of subject matter and the way it is presented, mobilizing concepts like cultural imperialism³⁹ and educational neocolonialism.⁴⁰ The educational targeting of evolving economies interspersed with the patriarchal overtones of traditional pedagogics may thus bring the notions of hegemony and dominance to the foreground, calling for a careful consideration of the power relations inherent in knowledge transfer through MOOCs.

A third significant barrier to MOOC participation is language. As Franco *et al* point out: “Most developing countries have local languages and only a small proportion of the population is competent in an international language, generally the language of the colonial occupiers”.⁷ According to UNESCO, in 2015 approximately 75 % of MOOCs were still taught in English.^{15(p46)} Insufficient language skills may inhibit participation as most available MOOCs require proficiency in English. Furthermore, an elementary formal education may be required in order to grasp the concepts in a foreign language. The development of MOOCs in other world languages is, however, becoming increasingly more common.⁷

Occupational Health in Developing Countries is targeted at a LMIC audience, and potential participants will necessarily run into barriers which are more prominent in LMICs.^{7,15,36,37} More data and research on barriers to participation is required in order to determine to which degree this is the case, and what may be done to overcome the barriers in order to accommodate target group participation. It would be relevant to attempt to identify these barriers, and tailor the course accordingly. Furthermore, mirroring some of the linguistic limitations of the course, the study of *Occupational Health in Developing Countries* has only considered English and Scandinavian literature, neglecting a great amount of valuable research on MOOCs in non-English and non-Scandinavian languages.

Gender representation

Similar to most MOOCs, as reported through MOOC research,²⁻⁵ the UiB's *Occupational Health in Developing Countries* MOOC, attracted a young and educated audience. Reflecting both the title and the intent of the course, however, a significantly higher proportion of participants attended the course from a LMIC geo-location. The high representation of LMIC participants in *Occupational Health in Developing Countries* must also be considered in light of the technical, sociocultural and linguistic barriers which may be assumed to have been encountered by many LMIC MOOC learners.

The MOOC phenomenon has been hailed as a potentially important contributor to the education of girls and women in LMICs.¹⁵ The high female representation in *Occupational Health in Developing Countries* should not be underestimated, and may illustrate the potential reach of the MOOC movement, and the potential for MOOCs for being an important contributor in balancing gender inequalities. The study, however, identified generally lower completion rates among female participants (35.1 %). The relatively low female completion rate in general, and among LMIC participants (33.8 %), compared to that of HIC participants (39.5 %), in particular, is problematic, and requires further investigation. With the limited data available, and the low response rates, one can only speculate on the reasons for the skewed gender distribution for completion rates. Considering the general gender inequalities in education, income, employability and advancement opportunities, this may, however, not be a very surprising result, and balancing gender inequalities should thus continue to be part of the MOOC's strategy. More research is, however, required to identify barriers to female, and especially LMIC female participant, course completion. The barriers may be technical, linguistic or sociocultural, and are most certainly interwoven into complex patterns of gendered role distribution.

Advertising

Research indicates that there is a generally low awareness of MOOCs in LMIC countries, and studies on student populations in LMICs suggest that the phenomenon is unknown to the majority of the students.⁵⁵⁻⁵⁷ For student populations, the educational institution may potentially serve as a promotor of MOOCs, providing of course that the educators and administrators

themselves are familiar with MOOCs. Outside the educational institutions, the marketing opportunities are even more limited. Social media, which are commonly used in many LMIC settings, is another obvious marketing channel, which could potentially be utilized more extensively for advertising MOOCs in LMICS.⁵⁵⁻⁵⁷ Out of 1130 pre-course survey respondents 59.8 % *Occupational Health in Developing Countries* participants reported that the course had been recommended to them by a friend. In the post-course survey 87.3 % of the 212 respondents were very likely to recommend the course to a friend, and 12.3 % were fairly likely to do the same. Other important sources of inspiration were, according to the pre-course survey, social media and the MOOC platform's web pages, e-mails or newsletters. There seems to be a potential for attracting more participants through targeted advertising and marketing of the course.

Data availability

Anonymous information on course completion and course step completion for all 148 individual course steps was registered automatically by FutureLearn, and was thus available for all participants. Geo-location data were, through a review of IP-addresses, provided by FutureLearn, and was available for all but 301 participants. The data was provided in csv format. Raw data in csv-format on geo-location, gender, age, education level, employment status and employment sector were obtained anonymously from voluntary self-reports, and were provided by FutureLearn. The csv-files were processed through the Statistical Package of Social Sciences (SPSS), version 24. The voluntary self-reported data were collected during course registration, with an average response rate of 11.2 %. Data on course expectations, motivations for participating, and on experiences with the MOOC and the MOOC platform were collected through anonymous and voluntary pre-and post-course surveys. The results were presented by FutureLearn in a statistical report along with a graphical presentations of participation activities. The response rates for the pre- and post-course surveys were 19.3 % and 3.9 %, respectively. Such low response rates can only serve as indications of tendencies.

The study suffers greatly from lack of data, and from the limitations of the available data. More data is required both for generating more statistically relevant results, but also for obtaining a more precise image of the course participant profiles and participation activities. Further research could also benefit from expanding and refining the data material,

both through the course registration procedure and through the pre-and post-course studies, in order to yield a more clear and detailed picture of the typical MOOC users, and in order to be able to determine and predict participation behavior more precisely. Higher response rates would greatly support the course assessment and would thereby potentially benefit future editions of *Occupational Health in Developing Countries*. Additional qualitative and quantitative data on course experiences could also be obtained by contacting participants directly. Commenting on data availability and on similarly low response rates, Sneddon *et al*, noted, that:

when developing an online education resource it is essential to scope what the delivery system can support in the way of data on user experience. It is acknowledged that voluntary user feedback surveys are likely to have a low response rate so are an unreliable method for demonstrating impact. To confirm impact, further surveys or other means of engagement with a larger number of learners are required (...). If technically feasible it would also be helpful to embed requests for feedback within the course content, providing opportunities for participants to provide ‘real-time’ information as the course progresses.⁵⁸

The same considerations are relevant for the data on participants and participation for *Occupational Health in Developing Countries*. On the other hand, the available data on *Occupational Health in Developing Countries* participants and participation were well-structured. There were only small deviations from the average response rate on the self-reported parameters (11.2 %), with the exception of the pre- and post-course surveys which had higher (19.3 %) and lower (3.9 %) response rates, respectively. The data amounts were considered sufficient to indicate the trends and tendencies of *Occupational Health in Developing Countries* participants and participation, and to accentuate topics which require further research.

Suggestions for further research

Future research could consider more targeted queries into participant profile data, including participation behavior and motivation. This could provide valuable information which could be relevant for similar courses, as well as for future revisions of *Occupational Health in Developing Countries*. Garrido and Koepke’s research on MOOC participation Colombia, the Philippines and South Africa also includes non-participants from relevant population

segments.³⁶ Further inquiries into non-participation could potentially yield important information on barriers to participation in MOOCs in general and, more specifically, in *Occupational Health in Developing Countries*. Qualitative data would furthermore be beneficial for determining the influence of sociocultural factors facilitating and impeding MOOC participation. *Occupational Health in Developing Countries* was running its seventh edition during the spring of 2019. The referred data concerns the first run of the course, which was launched in the spring of 2015. It would also be of great relevance to assess later editions of the MOOC for comparison in order to determine to which extent the identified patterns have persisted.

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OCCUPATIONAL HEALTH IN DEVELOPING COUNTRIES

– A MASSIVE OPEN ONLINE COURSE

Article formatted for the journal Archives of Environmental & Occupational Health

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OCCUPATIONAL HEALTH IN DEVELOPING COUNTRIES – A MASSIVE OPEN ONLINE COURSE

Abstract

In 2015 the University in Bergen launched the Massive Open Online Course (MOOC) *Occupational Health in Developing Countries*. The objective of this study is to describe the geographic and demographic diversity of the course participants, as well as the course participation activity with emphasis on low- and middle-income country (LMIC) learners. All data on MOOC participation were derived from the MOOC platform FutureLearn. Out of totally 5866 registrants, 72.4 % attended from a LMIC geo-location, and 71.9 % of the 768 course completers were LMIC residents. Most of the participants were young, well-educated and employed; mostly within the health and social sector. The gender distribution was almost equal, except from a higher female non-completer proportion, especially among LMIC participants. The MOOC succeeded in reaching its LMIC target group.

Keywords: MOOC, occupational, health, developing, LMIC.

Introduction

According to the International Labour Organization (ILO), occupational injuries and diseases are estimated to cause more than 2.78 million fatalities annually, of which most occur in low- and middle-income countries (LMICs).¹ Out of these, 380500 deaths are estimated to be caused by occupational accidents and 2.4 million by work-related diseases. In addition, a tremendous

amount of non-fatal occupational injuries and illnesses occur worldwide each day.¹ Many of these injuries and illnesses are preventable. LMICs comprise more than 75 % of the global workforce, out of which a considerable number of individuals work under unsafe conditions, and with an elevated risk of occupational injury or disease.² Occupational safety and health management systems are in many cases absent or insufficiently implemented in LMICs. The knowledge and awareness about factors involving occupational safety and health are often sparse in these countries.^{3,4} In addition to personal and social consequences, according to the ILO, occupational injuries and diseases constitute a considerable economic burden of an estimated annual 3.94 % of the global GDP, or 2.99 trillion USD.⁵

A strong occupational safety and health legislation, accompanied by the allocation of necessary and sufficient resources for establishing the systems required to manage such a legislation, is a fundamental requirement for protecting workers in LMICs.^{3,4} The education of workers, employers, occupational safety and health professionals and health care professionals is an integral part of the establishing or empowering of occupational safety and health systems in LMICs. The use of online resources like e.g. Massive Open Online Courses (MOOCs) is one way of reaching many, where the resources are sparse.⁶

According to the latest estimates (2018) from the International Telecommunications Union (ITU), 51.2 % of the world's population is now with some regularity connected to the internet.⁷ The number of internet users globally has almost reached 3.9 billion.⁷ Out of these, almost 2.9 billion users reside in LMICs.⁷ As the digital divide is gradually decreasing, MOOCs may become an increasingly important means of making high quality educational resources available to LMIC residents.

The literature on distance education of LMIC learners is sparse, and little research has so far been conducted to determine the participant profiles and the participation activities

of MOOC users in LMICs.⁸ Some studies on MOOC usage in LMICs have focused on important barriers to participation, as well as the actual reach and impact of MOOCs in LMICs.^{6,8-20} Similar attempts of digital transfer of knowledge and experience targeted at LMIC learners through other forms of distance learning like online, instructor-led courses, blended or mixed learning models have paved the way for the MOOC movement. They have, however, not been able to attract anything near the number of participants which the MOOC movement has.^{21,22} It is uncertain to which extent MOOCs actually manage to reach and influence LMIC MOOC learners, or, especially, even more marginalized segments of the LMIC population. It is also unclear how, and to which extent, technical, social, cultural and linguistic barriers affect MOOC learners in LMICs, and how these barriers may be overcome. Furthermore, it might be assumed that there could be differences in participation activities between LMIC and high-income country (HIC) learners, due to, and reflecting, differences in economic and material conditions, and differences in the existence and extent of national level occupational safety and health management systems. More research is therefore needed to conclude on the reach and impact of MOOCs in LMICs, and on how to facilitate distance learning on a truly global scale. In 2015, the Center for International Health, Department of Global Public Health and Primary Care at the University of Bergen (UiB), Norway, launched the MOOC *Occupational Health in Developing Countries* through the UK-based FutureLearn platform.²³ The course, which ran its seventh edition during the spring of 2019, results from a joint venture related to a Norad-funded project on Capacity Building in Higher Education and Research for Development (NORHED) at UiB, with partners from Addis Ababa University in Ethiopia and Muhimbili University of Health and Allied Sciences in Tanzania. The MOOC is explicitly aimed at sharing knowledge and experiences on occupational safety and health management with learners based in parts of the world where such systems are in a developing phase. *Occupational Health in Developing*

Countries could also be specifically useful for persons from HICs working with or in LMICs. The course thematizes occupational safety and health challenges, which are especially relevant to a LMIC audience, with articles and video clips taken from LMIC settings. The topics are, however, universal, and might be useful for anyone interested in occupational safety and health.

The objective of this study is to describe the geographic and demographic diversity as well as the course participation activity for the UiB's *Occupational Health in Developing Countries* MOOC, with emphasis on LMIC learners. Determining the profile of the typical LMIC MOOC learner may contribute to a better understanding, and targeting, of potential candidates, and hopefully, to a better accommodation of learners from LMICs. This information may be useful for further revisions of the course.

Materials and methods

Course description

The first edition of *Occupational Health in Developing Countries* was launched in March 2015. The MOOC was designed as a six-week program, and each week-module was divided into 24-28 sections. The course could be accessed using computer, tablet or mobile phone. The course content ranged widely, including a variety of occupational safety and health topics. *Occupational Health in Developing Countries* ran as a synchronous course, during which the teachers would, to some extent, interact with the learners. Many learners, however, entered the course after the start date, and thus followed the course asynchronously. The course content was presented through text, video-recorded lectures and video-clips from occupational settings in LMICs. The articles were richly illustrated with various graphics and photos. The

overarching topics were divided into six modules, one per week, roughly corresponding to 4 hours of work per week. The modules were: Basic concepts, chemical and biological factors and health at work, physical factors and health at work, work-related diseases, psychosocial factors and health at work, and care of the worker. Each module ended with a 10-question quiz based on the topics of the week. After the final lecture, the participants were offered to test their knowledge by completing the final 25-question quiz. All slides and sections of the course were accompanied by a commentary field, which could be expanded in order to leave comments or review the comments of others. During the course, the participants were intermittently invited to discuss questions and cases based on the presented topics. The educators sometimes responded to participant input, provided feedback, and added comments to stimulate discussion. After successful completion of the course, with at least 90 % of the course steps marked as complete, and with a minimum score of 70 % at the final quiz, at the cost of GBP 39, the participants were eligible to purchase a course certificate through the course platform.

Data sets

The research design is descriptive and analytic. All data on course participation and activity were provided by the FutureLearn MOOC platform. Qualitative information elaborating on the objectives of *Occupational Health in Developing Countries*, as well as on the structure and content of the course was provided by two of the course educators.

The data on participants and participation were available from registration of participant profiles and discussion input, and through anonymous pre- and post-course surveys. When enrolling for the course, participants were invited to anonymously register geo-location, age range, gender, employment status, employment sector and level of prior education. In the

following, these characteristics will be referred to as participant profiles, while the duration and level of course engagement and activity, measured through retention and completion rates as well as discussion and commentary input, will be referred to as participant activity.

The pre- and post-course survey questionnaires were offered to participants electronically by FutureLearn, and survey participation was optional. The pre-course survey described learner expectations and prior experiences with FutureLearn, while the post-course survey covered participant experiences on a variety of aspects of the course, including current experiences with the MOOC platform. Some of the collected data had been processed and presented in a report created by FutureLearn for the UiB. The report commented on enrollment, activities, comments, as well as on quizzes and tests. The report, however, did not distinguish between LMIC and HIC learner, or other subgroups of course participants.

Activity level was tracked through participation rates for each individual module and section of the course. These data were used to analyze participation activities for the respective participant groups, and to track participant activity level through the progression of the course. Activity level was available both for the whole course as well as for each individual course module and section.

FutureLearn provided raw data in csv-format on geo-location, gender, age, education level, employment status and employment sector, as well as on participation activity, course step completion and course completion for most participants. Only step activity and completion rates were available for all participants. Geo-location was, through a review of IP-addresses, available for all but 301 participants. All other parameters were self-reported, with an average of approximately 12 % of the participants more or less inconsequently registering participant data. The csv-files were processed by the Statistical Package of Social Sciences

(SPSS), version 24. Table 1 describes the data types and data sources that were utilized in the study.

In the present text, the residential countries of the participants have been divided into developing, or LMIC, and developed, or HIC, according to the United Nations' Country Classification list.²⁴ Transition economies have been included in the LMIC category. In the text, geo-location will be used intermittently with, and synonymously with, country of residence.

The text distinguishes between *completers* and *non-completers*, with the former corresponding to FutureLearn's criteria for *full participation*, which require completing more than 50 % of the course steps and all of the test questions.²⁵ The concept *participants* covers all persons having engaged with the course, regardless of duration or type of engagement. *Course steps* refer to the 24-28 sections within each course module, and *step activity* measure the number of participants engaging in each course step.²⁵ Non-completers comprise the majority of the course participants, and the category includes everything from people who only registered for the course to participants who almost reached the level of full participation.

Results

Data on all participants

Out of a total of 5866 participants, 768 (13.1%) completed the course (Table 2). Of all participants, 4249 (72.4 %) attended from a LMIC geo-location, and 1316 (22.4 %) were from HICs. The geo-location of 301 (5.1 %) participants was unknown. Out of the 768 completers, 552 (71.8 %) were LMIC residents, and 180 (23.4 %) were from HICs. The geo-location of 36 completers was unknown. The LMIC and HIC participant completion rates were similar (13.0

% and 13,7 %, respectively). The geo-locations with the highest number of participants were Nigeria (13 %), UK 12 (%), Ghana (11 %), USA (6 %), Norway (4 %), South Africa (4 %), Kenya (3 %), Tanzania (2 %), Indonesia (2 %) and Singapore (2 %).

The 5866 course participants completed 158 091 course steps. The decline in week-to-week activity demonstrates similar trends among LMIC and HIC participants. Figure 1 describes the gentle decline in number of course completers completing individual course steps (Figure 1), while figure 2 describes a much steeper decline in number of non-completers completing individual course steps (Figure 2). Among the completers there is a steady decline of up to 5 % in step activity from one week to the next, while among the non-completes the step activity decline is approximately a tenfold higher, with an overall decline of almost 95 %. As it appears, LMIC and HIC participants have followed a similar pattern in their consumption or rejection of the course content.

A total of 23 547 comments from the participants could be associated with a geo-location. Out of these, 18108 (76.9 %) of the input was provided by LMIC residents and 5439 (23.1 %) by HIC residents.

Self-registered data

Gender

Only 660 of the 5866 participants registered their gender when enrolling, and among these 308 (46.7 %) were females, and 352 (53.3 %) were males (Table 3). Out of these 660 participants, 514 (77.9 %) were LMIC residents, while 146 (22.1 %) resided in HICs. Female representation among LMICs was 235 (45.7 %), and male representation was 279 (54.3 %). Among the 146

HIC participants, both the female and male group counted 73 (50 %) each. Out of the 660 participants who registered their gender, 174 (26.4 %) completed the course. The difference between female and male completers in both LMICs and HICs was considerable. Out of the 136 LMIC completers, 46 (33.8 %) were female, while 90 (66.2 %) were male. Out of the 38 HIC completers, 15 (39.5 %) were female and 23 (60.5 %) were male.

Age

A total of 647 participants, 502 of which were from LMICs, registered their age upon enrolment. Between 7 age ranges (<18, 18-25, 26-35, 36-45, 46-55, 56-65, >65), the ranges 26-35 years and 36-45 years were by far the largest, both among LMIC and HIC participants. Out of the total, only 2 (0.3 %) participants were below 18. There were 78 (12.1 %) participants in the age range 18-25, 248 (38.3 %) in the age range 26-35, and 173 (26.7 %) in the age range 36-45. There were 78 (11.1 %) participants in the age range 46-55, and 49 (7.8 %) in the age range 56-65. Only 14 (3 %) participants were above 65. The age ranges with the largest representation, 26-35 and 36-45, had 195 (38.9 %) and 135 (26.9 %) LMIC participants, respectively. The age distribution among the 145 HIC participants was very similar, with 53 (36.6 %) participants in the age range 26-35 years, and 38 (26.2 %) participants in the age range 36-45 years.

Employment sector

Out of 609 respondents, 309 (50.9 %) reported being employed in the health and social sector (Table 4). When stratifying with respect to HIC/LMIC, a similar pattern emerged, with an

even gender distribution, but a somewhat higher percentage of health and social sector employees among HIC participants. As many as 57.1 % of HIC participants were health and social sector employees, The corresponding number among LMIC participants was 48.8 %. Out of the total of 309 health and social sector employees, 52.2 % were male, and 47.8 % were female.

Education

Upon enrolment, 91.2 % out of 661 respondents, reported having education above secondary level (Table 5). Among the LMIC and HIC participants, 90.7 % and 93.1 %, respectively, reported having completed education above secondary level.

Employment status

Out of 652 respondents, 57.8 % reported upon enrolment to be full-time employed. The number of full-time employed participants was 68.1 % among male LMIC participants, 46.5 % among female LMIC participants, 60.4 % among male HIC participants, and 55.1 % among female HIC participants.

Pre-course survey data

Marketing and advertising

When asked how they found out about the course, 59.8 % of the 1130 respondents in the pre-course survey reported that a friend had recommended the course to them. In the post-course survey, 87.3 % of the 212 respondents were very likely to recommend the course to a friend, and 12.3 % were fairly likely to do the same. As few as 11.7 % found the course through a social media message, and 9.2 % found it while browsing FutureLearn's website. There were no data available to discern between LMIC and HIC respondents.

Motivation

When responding to questions on motivation for participating, the respondents were asked to tick all applicable alternatives. Out of 1230 respondents, 62.3 % hoped that the course would improve their career prospects, 53.3 % hoped to learn new things, and 52 % hoped that the course would add a fresh perspective to their current work. There were no data available to discern between LMIC and HIC respondents.

Post-course survey data

Course satisfaction

Out of 228 post-course survey respondents, 83-95 % reported to like or strongly like different aspects of the course design and content. As much as 93.9 % reported finding the educators fairly or very engaging. Out of 216 respondents, 65.7 % rated the overall experience of the course as excellent, and 28.7 % rated the experience as good. Out of 226 respondents 65.5 % reported that the course difficulty met their expectations. Out of 222 respondents 76.6 % felt

that the length of the course was about right. Again, there were no data available to discern between LMIC and HIC respondents.

Discussion

Occupational Health in Developing Countries reached its LMIC target audience, with a LMIC enrolment rate of 72.4 %. The typical user of this MOOC was young, well-educated and employed. Most participants were health and social sector employees. Only small differences were identified between the LMIC and HIC participant groups with respect to age, gender, education level, employment status and employment sector. Furthermore, there were few differences in participation patterns between the two groups. *Occupational Health in Developing Countries* LMIC and HIC completion rates were almost identical. There was, however a considerably lower completion rate among female participants in general, and especially among female LMIC participants. Apart from the proportional difference between LMIC and HIC participation, there were few considerable differences in participation activities between the two groups. *Occupational Health in Developing Countries* also had a completion rate, which is very close to the overall MOOC completion average across the different MOOC platforms.

Participant profiles

Occupational Health in Developing Countries enjoyed a relatively large representation of LMIC participants. As many as 72.4 % of the course participants were from the primary, LMIC, target group. In contrast to many previous research results on MOOC users,^{15,26-28} the genders

were almost equally represented in the UiB's MOOC, with only a 3.7 % male overrepresentation. Similar to many previous research results on MOOC users,^{15,26-28} however, the typical *Occupational Health in Developing Countries* participant was also a young, well-educated person. Most of the course participants held a university degree. The vast majority of *Occupational Health in Developing Countries* participants were health and social workers, which must be considered a relevant field for applying and dispersing the information provided through the course. Most of the course participants were also full-time workers.

The typical *Occupational Health in Developing Countries* learner was well-educated with as many as 91.2 % reporting a prior education level above secondary school. The subject of *Occupational Health in Developing Countries*, interfaces with both medical, social and technical sciences. Thus, it may not be surprising there was a relatively fair gender balance and that the vast majority of the participants were health and social workers, which must be considered a relevant field for applying and dispersing the information provided through the course. Other research on MOOC audiences has described the typical MOOC participant as a young, educated male residing in Europe or North America.^{15,26,27} Computer science, technology, engineering and mathematics are among the most popular MOOC subjects.³¹ A study of the University of Edinburgh's six first MOOCs revealed somewhat similar patterns, nevertheless, with a few important discrepancies.²⁹ The authors also observed, however, that gender was closely associated with subject, with males being overrepresented in courses on technical subjects, but that the overall recruitment was approximately the same for males and females, leading the authors to conclude that MOOCs are not only for "male geeks" after all.²⁸

Responding to questions on their motivation for attending the course, most *Occupational Health in Developing Countries* participants stated that they hoped that the course would improve their career prospects. Hoping "to learn new things", and being provided with

a fresh perspective to their current work also ranged as the most important motivators for attending the course. A study on motivations for MOOC participation in BRIC (Brazil, Russia, India and China) found job advancement and satisfying curiosity to be the primary motivators.²⁶ The desire to learn new things corresponds well with the primary reason stated for participation in the University of Edinburgh's six first MOOCs, although career enhancement was also a strong motivator, especially for developing country participants.²⁹ Career advancement was also the primary reason stated for participation by the 34779 respondents in a study of the University of Pennsylvania's first 32 MOOCs.³⁰

Participation activity

With the exception of the proportional difference between LMIC and HIC *Occupational Health in Developing Countries* participation, there were few considerable differences in participation activities between the two groups. The initial assumption that differences in economic and material conditions are determinative for participation activities, such as the emphasis of certain topics or sections of *Occupational Health in Developing Countries*, or for overall completion rates, is thus unsupported. Furthermore, the analysis of commentary input yielded a LMIC contribution which was almost perfectly proportional to the overall LMIC participation rate.

Completion rates

Occupational Health in Developing Countries had a completion rate of approximately 13 % for both LMIC and HIC participants. This is very close to the overall MOOC completion average across the different MOOC platforms, although the definitions of MOOC participation and

completion do vary between different platforms.^{25,31,32} While MOOC participation in terms of enrolment has seen numbers of up to tens, even hundreds of thousands, the average MOOC completion rate is relatively low, generally between 5-15 %.^{31,32} However, 5-15 % of very many is still many, and, as phrased by Ho *et al*, “small percentages are not small numbers”.³¹ Furthermore, completion rates may not at all be such a relevant quality criterion for MOOCs, for which signing up, even only in order to browse the course content, is free, quick, easy and non-committal, and for which completion, at least in the case of hedonic participants, completion seldom serve other functions than personal satisfaction and self-affirmation. Again, the traditional understanding of course participation patterns as an indicator of quality may not be completely applicable for MOOCs. A recent study on MOOC participation in the Philippines, Columbia and South-Africa, however, identified an even more complex and heterogeneous picture of LMIC MOOC participants, and revealed significant differences between countries and regions.⁸ The study found significantly higher completion rates in LMICs than in HICs, and reported low- and medium-income strata participants to represent the majority of MOOC participants in the Philippines, Columbia and South Africa.⁸

Barriers to participation

Barriers to MOOC participation, which have been demonstrated in other studies,^{6-8,10,16,33} and which especially can be unfavorable with respect to LMIC female participation, and perhaps, due to general gender inequalities, even more so to female participation, may also be relevant to *Occupational Health in Developing Countries*. The most important barriers to MOOC participation can be divided into technical influences, cultural influences and language

influences. All of these barriers, which will be highlighted below, are considerably more prominent in the developing world.

Technical barriers

The most obvious barriers to MOOC participation relate to the technical prerequisites for attending the course in the first place. No data was available on actual or potential impact of technical barriers to participation in the UiB's MOOC, but the technical challenges encountered by LMIC participants have been thoroughly considered by the course developers. Previous research has described technical barriers as one of the primary obstacles to MOOC participation in LMICs.^{7,8,16} Only approximately half of the world's population has internet access,⁷ and the internet penetration in LMICs is unevenly distributed, leaving especially rural areas unconnected.¹⁶ While mobile phone is the dominant device for accessing the internet, very few MOOCs, are designed to work on mobile platforms.⁸ One of the few MOOCs which does operate on mobile platforms, however, is *Occupational Health in Developing Countries*, making the course available to a considerably greater audience in LMICs.

Cultural barriers

Cultural factors constitute another important set of barriers to participation. With courses being developed within one dominant cultural perspective, there is a risk that the cultural diversity of the students is neglected. This can potentially have a negative impact on both the subject matter and the teaching method.^{6(p33)} No data was, however, available on the actual or potential impact of cultural barriers to participation in the UiB's MOOC. The cultural diversity of the potential

course audience has, however, been considered by the course developers, and *Occupational Health in Developing Countries* was developed in collaboration with Addis Ababa University in Ethiopia and Muhimbili University of Health and Allied Sciences in Tanzania.

Language barriers

A third significant barrier to MOOC participation is language. No data was available on the actual or potential impact of language barriers to participation in the UiB's MOOC. Approximately 75 % of MOOCs are still taught in English.^{6(p46)} As most available MOOCs require proficiency in English, insufficient language skills may inhibit participation. *Occupational Health in Developing Countries* is, however, currently only available in English, and thus unavailable to large non-English speaking audiences. The geo-locations with the highest numbers of *Occupational Health in Developing Countries* participants are English-speaking countries, (Nigeria, UK, Ghana, USA, South Africa, Kenya) or countries with a high degree of English language proficiency (Norway, Singapore, Tanzania).

Gender

Occupational Health in Developing Countries had a high female representation (overall 46.7 %) from both LMICs and HICs (45.7 % and 50 % respectively), but a relatively low completion rate among female participants (overall 35.1 %), especially among female LMIC participants (33.8 %). In contrast, Garrido and Koepke's study on MOOC participation in the Philippines, Columbia and South-Africa found women to be more likely to complete a MOOC or get certified.⁸ Similar, however, to *Occupational Health in Developing Countries*, young employed

participants were found more likely to achieve higher rates of completion and certification.⁸ The rise of global internet connectivity and the increasing amount of available online educational resources may contribute to the achievement of the United Nations' Sustainable Development Goal 4; to *ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*.³⁴⁻³⁶ In this perspective, *Occupational Health in Developing Countries* has the potential of reaching audiences who may not have access to traditional learning resources. MOOCs have also been hailed as a potentially important contributor to the education of girls and women in LMICs.^{6,34} As online resources potentially are able to reach a much broader public than traditional educational resources, MOOCs can also contribute to the efforts towards reaching the United Nations' Sustainable Development Goal 5; to *achieve gender equality and empower all women and girls*.³⁴⁻³⁶ The high female representation in *Occupational Health in Developing Countries* should not be underestimated, and may illustrate the potential reach of the MOOC movement. The relatively lower female completion rate, especially amongst LMIC participants is, however, problematic, and requires further investigation.

Strengths and weaknesses

The present study includes an assessment and a contextualization of the UiB's MOOC *Occupational Health in Developing Countries*. The supervisors of the present study are also two of the developers of the programme, as well as educators for the same MOOC. Representing a unique source of proximity to, and insight into, the programme, this must also be acknowledged as a potential for partiality and for conflicting interests. The supervisors have

provided qualitative data on the programme, and elaborated on the content and the design, as well as the intentions and purposes of the MOOC.

One of the challenges encountered while studying the participant profiles and participant activities of *Occupational Health in Developing Countries* has been the amount and structure of the available data, with low response rates and very often different respondents for each question. Furthermore, both the LMIC/HIC division, as well as the use of geo-location as an indicator for the individual participant's engagement with occupational health in developing countries, can be challenged. Data on geo-location was available through a review of the IP-addresses of all but 301 participants, and step completion rates and course completion rates, were registered for all participants. Furthermore, the comparability of some of the results of this study with those of similar studies can also be questioned, as the various platforms operate with different criteria for completion and non-completion. One author commented on the constraints on MOOC assessment caused by low voluntary feedback and survey response rates, suggesting to include more mandatory feedback, or, if possible, to embed requests for feedback within the course content.³⁷

The response rates for the voluntary course registration parameters relating to gender, age, education level, employment status and employment area, however, were between 10.9 % and 11.9 %. The response rates for the pre-and post-course surveys were 19.3 % and 3.9 %, respectively. Such low response rates may not give a representative picture of the actual similarities and differences in LMIC and HIC participation, and can only serve as indications of tendencies of such.

Conclusion

Education is an integral component in establishing and empowering occupational safety and health systems in LMICs. The ultimate purpose of *Occupational Health in Developing Countries* is the translation of the theoretical knowledge into practical actions on the side of the learner in the LMIC occupational setting. The first edition of *Occupational Health in Developing Countries* caught the attention of 5688 participants, out of which 768 completed the course. Almost three fourths of the participants were LMIC residents, and thus belonged to the primary target group of the course.

In contrast to many previous research results on MOOC users, the genders were almost equally represented in the UiB's MOOC, with only 3.7 % male overrepresentation. Similar to many previous research results on MOOC users, however, the typical *Occupational Health in Developing Countries* participant was also a young, well-educated person in a full-time job. The vast majority of *Occupational Health in Developing Countries* participants were health and social workers, which must be considered one of the more relevant fields for applying and dispersing the information provided through the course.

Another important observation is related to the marketing of the course. Most of the inspiration for attending the course seems to be based on word-of-mouth marketing. Most respondents on the pre-course survey learnt about the course through word-of-mouth accounts, and a great majority of the post-course respondents would recommend the course to a friend. There is all reason to believe that broader marketing and advertising strategies could attract more, and perhaps even more diverse, audiences. *Occupational Health in Developing Countries* is compatible with mobile platforms, and is thus available to large audiences operating

predominantly on mobile phones. Through translations to other world languages, *Occupational Health in Developing Countries* could be made available to even broader audiences.

More targeted queries into participant profile data, including participation behavior and motivation may yield valuable information which may be relevant for similar courses as well as for future revisions of *Occupational Health in Developing Countries*. It would also be relevant to assess recent editions of the MOOC for comparison in order to determine to which degree the identified patterns have persisted. More research on LMIC MOOC learners is required, and especially on how to accommodate marginalized groups and to increase the MOOC retention rate. Of particular interest are the relative low completion rates amongst female learners, especially female LMIC participants.

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Tables

Table 1

Self-registration at enrollment (FutureLearn - csv-file)	Automatic registration at enrollment (FutureLearn - csv-file)	Pre-course survey after enrollment (FutureLearn - Descriptive report)	Post-course survey after course (FutureLearn - Descriptive report)
Geo-location	Geo-location (collected through screening of IT-addresses)	Previous experience with MOOC platform	Course evaluation - satisfaction with content
Age	Activity - step completion	How participants learned about the course	Course evaluation - satisfaction with form
Gender	Activity - course completion	Motivations for participating	Course evaluation - satisfaction with course length
Education level			Course evaluation - satisfaction with educators
Employment sector			Likelihood for recommending the course to others
Employment status			

Table 1: Overview of the quantitative data sources utilized for the study.

Table 2

	LMIC	HIC	Unknown	All
Completers	552 (9,4 %)	180 (3,1 %)	36 (0,6 %)	768 (13,1 %)
Non-completers	3697 (63,0 %)	1136 (19,4 %)	265 (4,5 %)	5098 (86,9 %)
Total	4249 (72,4 %)	1316 (22,4 %)	301 (5,1 %)	5866 (100 %)

Table 2: Numbers of participants from low- and middle-income country (LMIC) and high-income countries (HIC) stratified by completers and non-completers

Table 3

	Female	Male	Total
Completers			
LMIC	46 (33.8 %)	90 (66.2 %)	136 (100 %)
HIC	15 (39.5 %)	23 (60.5 %)	38 (100 %)
Total	61 (35.1 %)	113 (64.9 %)	174 (100 %)
Non-completers			
LMIC	189 (50 %)	189 (50 %)	378 (100 %)
HIC	58 (53.7 %)	50 (46.3 %)	108 (100 %)
Total	247 (50.8 %)	239 (49.2 %)	486 (100 %)
All			
LMIC	235 (45.7 %)	279 (54.3 %)	514 (100 %)
HIC	73 (50 %)	73 (50 %)	146 (100 %)
Total	308 (46.7 %)	352 (53.3 %)	660 (100 %)

Table 3: Distribution of female and male low- and middle-income country (LMIC) and high-income country (HIC) course completers and non-completers among participants who registered their gender at enrollment

Table 4

	LMIC	HIC	Total
Health and social care	229 (48.8 %)	80 (57.1 %)	309
Teaching and education	38 (8.1 %)	8 (5.7 %)	46
Engineering and manufacturing	30 (6.4 %)	5 (3.7 %)	35
Public sector	25 (5.3 %)	10 (7.1 %)	35
Business consulting and management	24 (5.1 %)	5 (3.7 %)	29
Science and pharmaceuticals	16 (3.4 %)	4 (2.8 %)	20
Charities and voluntary work	14 (3 %)	4 (2.8 %)	18
Environment and agriculture	15 (3.2 %)	3 (2.1 %)	18
IT and information services	13 (2.8 %)	2 (1.4 %)	15
Property and construction	13 (2.8 %)	1 (0.7 %)	14
Accountancy, banking and finance	8 (1.7 %)	5 (3.6 %)	13
Creative arts and culture	5 (1.1 %)	3 (2.1 %)	8
Energy and utilities	7 (1.5 %)	1 (0.7 %)	8
Hospitality, tourism and sport	6 (1.3 %)	1 (0.7 %)	7
Law	6 (1.3 %)	0	6
Recruitment and PR	3 (0.6 %)	3 (2.1 %)	6
Marketing, publishing and PR	3 (0.6 %)	2 (1.4 %)	5
Media and publishing	3 (0.6 %)	2 (1.4 %)	5
Retail and sales	3 (0.6 %)	1 (0.7 %)	4
Armed forces and emergency services	2 (0.4 %)	0	2
Transport and logistics	6 (1.3 %)	0	6
Total	469 (100%)	140 (100 %)	609

Table 4: Distribution of low- and middle-income country (LMIC) and high-income country (HIC) participant employment sector of respondents at enrollment.

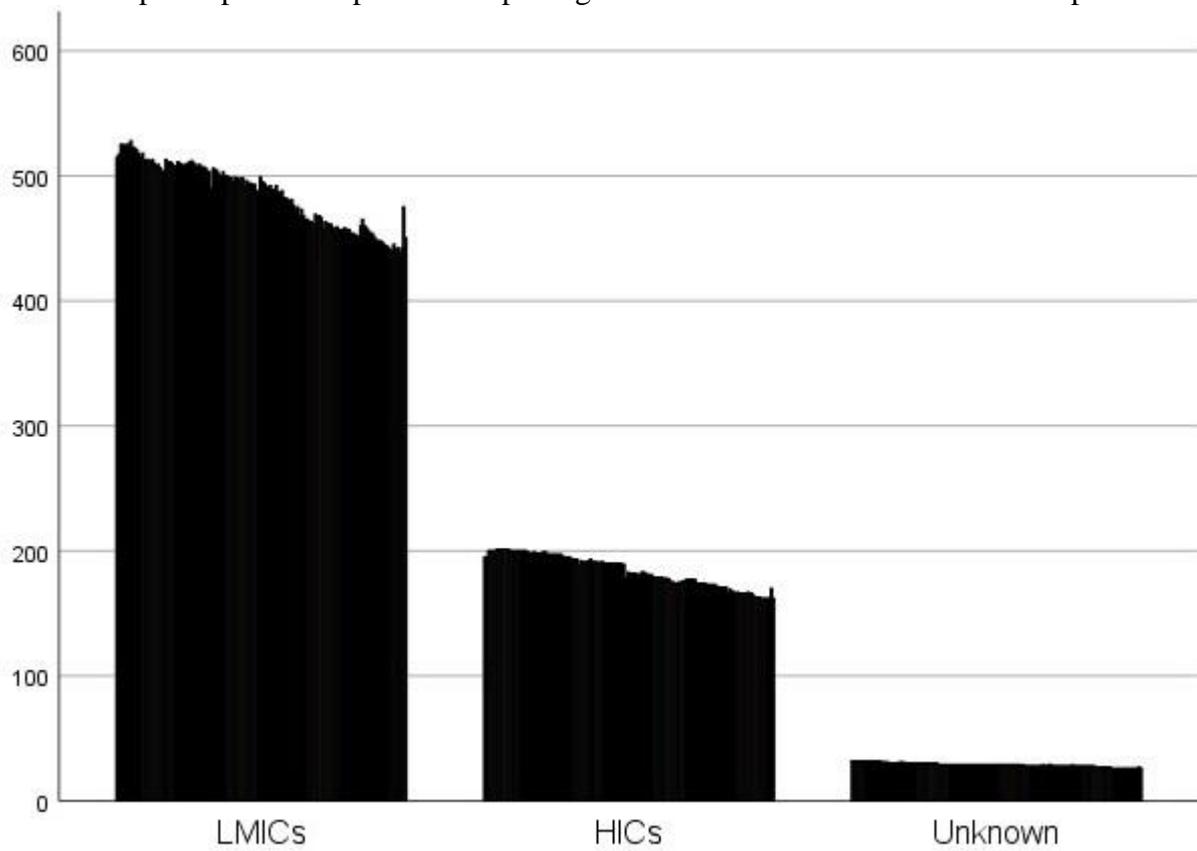
Table 5

	LMIC	HIC	Total
University degree	271 (52.4 %)	67 (46.5 %)	338
Working part-time	118 (22.8 %)	41 (28.5 %)	159
Secondary	44 (8.5 %)	9 (6.25 %)	53
University doctorate	32 (6.2 %)	9 (6.25 %)	41
Tertiary	35 (6.8 %)	5 (3.5 %)	40
Professional	13 (2.5 %)	11 (7.6 %)	24
Less than secondary	4 (0.8 %)	1 (0.01 %)	5
Apprenticeship	0	1 (0.01 %)	1
Total	517 (100 %)	144 (100 %)	661

Table 5: Distribution of low- and middle-income country (LMIC) and high-income country (HIC) participant education level of respondents at enrollment.

Figure 1

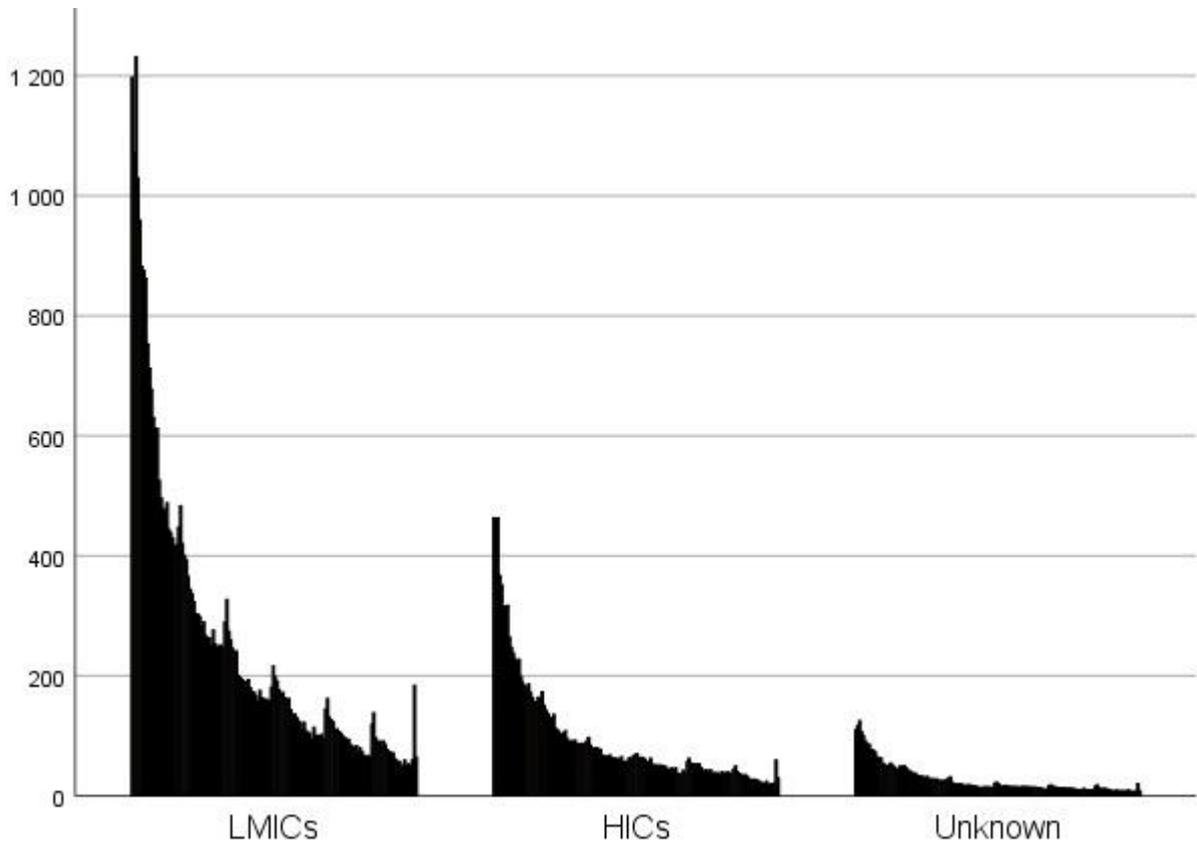
Number of participants completers completing each of the 148 individual course steps.



Individual course steps. Each bar counts 148 course steps.

Figure 2

Number of non-completers completing each of the 148 individual course steps.



Individual course steps. Each bar counts 148 course steps.

Figure captions

Figure 1: Number of course completers completing individual course steps, divided into low- and middle-income country (LMIC) and high-income country (HIC) participant course progression, as well as the course progression of participants whose geo-location is unknown. The x-axis describes the 148 individual course steps, and the y-axis indicates the number of participants completing each of the 148 individual course steps.

Figure 2: Number of non-completers completing individual course steps, divided into low- and middle-income country (LMIC) and high-income country (HIC) participant course progression, as well as the course progression of participants whose geo-location is unknown. The x-axis describes the 148 individual course steps, and the y-axis indicates the number of participants completing each of the 148 individual course steps.