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Deutsches Klima Konsortium

WWF

Federal Foreign Office

Guide for use of the #ClimateCourse MOOC in the academic context

Climate Change, Risks and Challenges

Imprint

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Foreword

Man-made climate change is one of the major challenges of the century. After more than 30 years of intensive research and committed climate policy at local, national and international level, the trend towards reduced emissions has not yet been established. The questions of how mankind can limit climate change to well below two degrees, as specified in the Paris Agreement in 2015, and adapt to climate change that can no longer be avoided have become more urgent.

Increasingly more areas of activity and study, such as agriculture and forestry, administration, healthcare, civil protection, construction and housing, energy and water management, and teacher training, can no longer do without sound knowledge of climate change and strategies to limit and adapt to it.

This is where the Massive Open Online Course (MOOC) 'Climate Change, Risks and Challenges', developed by the German Climate Consortium (DKK) and the World Wide Fund for Nature (WWF), comes into play: it provides society with current and interdisciplinary knowledge about climate change in an online learning format, free of charge and independently of time and place.

Knowledge transfer, dialogues between science and society, and acquiring competences in climate change, climate protection and climate-change adaptation have become particularly important, since we cannot refer to cultural experience to solve the climate issue. Whoever recognises the urgency of the problem and is familiar with the available options for action can make sustainable decisions and take action themselves.

This guide has been developed to make it easier for universities to use the 'Climate Change, Risks and Challenges' online course in their curriculum. The guide includes background information on the course format, scientific content and teaching methods, as well as suggestions for use of the online course as a pure, unsupervised, stand-alone course, as an elective or required module, or in a blended learning scenario in the academic context. It then concludes with two interesting case studies on the use of the MOOC in a specific university context that make the limitations and basic conditions of use even more apparent.

Climate change and its impacts for life on Earth require concerted action at all levels of society, from policymaking to personal behaviour in daily life. If this guide helps you use the free, high-quality 'Climate Change, Risks and Challenges' course, we will have achieved our goal. The Federal Foreign Office has kindly provided financial support for this international project.

We wish you all success in using the course in your curriculum.

Bettina Münch-Epple

Head of the Education Division
WWF Germany

Marie-Luise Beck

Managing Director
German Climate Consortium

Content

1. Introduction

In the 'Climate Change, Risks and Challenges' MOOC, leading German climate scientists explain the scientific basics that facilitate the understanding of the complex and global problem of climate change and its possible solutions. Hence, it is important to consider the issue from various perspectives, that is, the scientific, political, economic and socio-scientific perspectives, in order to be able to categorise the facts.

Such findings are didactically encapsulated in the #ClimateCourse MOOC 'Climate Change, Risks and Challenges'.

Experts on climate and climate impact research help to ensure that decisions and action relevant to the climate are based on scientific evidence.

2. What is a MOOC?

"[...] a Massive Open Online Course is one way of learning in a networked world. A MOOC is a course: it's open, it's participatory, it's distributed, and it supports lifelong networked learning."[1]

"Massive Open Online Courses (MOOCs) are digital teaching formats that incorporate ideas for the further development of e-learning, Web 2.0 and open educational resources. They can be used before, during and after the course of study, and integrated at the course, module and degree level for teaching purposes."[2]

MOOCs were originally conceived as **open educational resources** (OERs) and can be integrated into various learning contexts depending on the licence and the specific requirements.

MOOCs are available on specialised online learning platforms worldwide, accessible through a browser at any time and any place. This enables course providers to address an

[1] Source: David Cormier, 2010. What is a MOOC? YouTube Video
[2] Source: HRK, 2017. Endversion, pdf (German only)

international audience and establish international networks, which could result in very large numbers of users, some MOOCs having more than a million registered users.

Participation in such courses is generally free of charge and open to anyone interested, without any prerequisites.

3. International and national MOOCs

Well-known examples of learning platforms specialising in MOOCs for English-speaking countries—where this type of course was developed—are edX and Coursera in the United States and FutureLearn, a subsidiary of The Open University in Milton Keynes in England.

German learning platform providers are iversity in Berlin, openHPI operated by the Hasso Plattner Institute in Potsdam, iMooX, developed by the University of Graz, and mooin developed by the Luebeck University of Applied Sciences.

3.1. History of the MOOC

Stephen Downes and **George Siemens**, both Canadian, were the first to experiment with a web-based, open and large-scale type of course in 2008. They called this first MOOC '**Connectivism and Connective Knowledge**' (CCK08). Its didactic focus was social learning based on networked participants.

This type of course was later called **cMOOC** to distinguish it from the traditional instructional design of the **xMOOC**.

xMOOCs were the online courses provided by American universities such as Stanford, which made recordings of lectures, particularly those related to computer sciences, available online, free of charge. It soon became clear that this online glimpse of local study programmes aroused great interest and resulted in a knock-on PR effect that other universities did not fail to notice. Thus, the open course format garnered initial attention.

Teaching in **cMOOCs** ran counter to the traditional top-down didactic model of the lecture as proposed by the precursors from Stanford. The opportunity for participants to interact through web-based networked communication was now incorporated into the course.[3]

Web 2.0 had developed its own bottom-up, grass-roots nature with user-generated content. This idea was applied to the course and was intended to encourage and foster knowledge acquisition and content creation by the learners themselves.

3.2. Teaching and learning in the modern MOOC

The teaching approach of the cMOOC is connectivism. Connectivism (network learning) is based on the assumption that collective intelligence can produce efficient and/or high-quality learning experiences for all participants in equal measure. The focus is purely on social interactive learning without specific instruction. Given the great heterogeneity of participants' prior knowledge, it turns out that this approach is not entirely viable.

Besides, experience has shown that the strongly pre-structured traditional courses typical of xMOOCs are preferred both by learners with little prior knowledge and by advanced learners.

Hence, the greater the participants' **heterogeneity**, the more important the proportion of traditional instructional design. Consequently, a manner that addresses the **greatest possible common denominator for learners' prior knowledge**, which will serve as the basis for the essential course content, must be found. Social interaction and reflection can only be secondary in contributing to the quality of the learning.

[3] Source: Wikipedia. Link

Should a common knowledge base not first be established, there would be the risk that learners' communication would primarily focus on eliminating misunderstanding, at the expense of motivation and, ultimately, learning progress.

Nowadays, the strict separation of bottom-up and top-down designs would no longer make sense. A **modern course design** would include both didactic aspects:

- **an effectively pre-structured and successive presentation of learning content to ensure that the big differences in prior knowledge are all considered; and**
- **an opportunity to practise and reflect within the social learning context, for example, by participating in forums with appropriate exercises, which would serve to elaborate and consolidate the newly acquired knowledge.**

The provider and the content experts are responsible for **monitoring the quality of the content**.

Both the **instructional design** and the overall user experience design of the course—the **learning experience**—require specific expertise in didactic media and user experience. The online learning behaviour (navigation and learning interactions using the graphical interface of the course, and the social component of the online communication between learners and, if necessary, with teachers) must be designed effectively.

The **major weakness** of a pure online course is the lack of continuous personal contact and interaction with other students. MOOCs have very high drop-out rates and a completion rate of only 5–10% for the open course format that is not incorporated into a local curriculum. These high drop-out rates are ascribed to the fact that learners are less socially involved and learning behaviour in digital, unsupervised courses is different. Therefore, blended learning formats seem to us to be a very suitable form of learning because they incorporate the advantages of both worlds.

This manual is intended to support this approach.

The **look & feel, tone and interactivity of the digital programme** are therefore considered **important factors in developing a MOOC** because, unlike actual lessons, there are no lecturers to direct attention and motivation during the learning process.

The target group is usually very heterogeneous, and the general (social) course context requires a low-threshold approach that also incorporates the more sophisticated specialist content.

To at least partially compensate for the **lack of direct feedback** in any stand-alone online programme, various technical and instructional psychology tools are used to at least ensure that learners have a largely uncomplicated learning experience and:

- do not get lost when navigating through the information architecture;
- are not defeated by other workflow issues or information overload;
- do not quit because the feedback is not helpful; or
- do not prefer other activities because they have a more favourable subjective and motivational benefit–cost ratio, that is, these other activities are more important or more pleasant.

What cannot be controlled is the lack of non-verbal communication and the learner's own frustration tolerance. Social comparison and communication problems are often more difficult to bear online than in 'real' life. Online occurrences are much more susceptible to subjectivity (fears and expectations) because the non-verbal cues are simply not there.

To compensate for this lack of social 'regulation', **moderators** often chair forum activities or organise additional webinars. However, since MOOCs typically have **high numbers of participants**, which would require much effort to assist, moderators are generally only present in the first run.

Subsequent runs of the **MOOC** are generally **unsupervised**, webinars are eliminated and course facilitators' **forum activities** must then be **automated**. Hence it is **not possible** to **monitor the quality of the content** of forum posts.

In consideration of the limitations of a pure, unsupervised online programme on the psychological needs of the participants, **blended learning scenarios** afford a measure of compensation by effectively combining:

- a flexible, online self-learning situation; and
- a classroom teaching and learning situation with its real-life advantages of directing attention and personal feedback.

However, MOOCs are pure online courses in the first place.

4. How is the #ClimateCourse MOOC structured?

The #ClimateCourse is hosted on the **mooin** platform. This is a Moodle-based course platform with its own look and feel that fulfils the MOOC's typical requirement of an intuitive user experience through simplified information architecture.

Videos are hosted on YouTube and embedded into the course with the familiar YouTube functionality.

Below is a typical startup screen of a video in which the moderator addresses the learners.

Fig. 1: Screenshot of a video featuring moderator Helena Humphrey in the #ClimateCourse MOOC

The teaching method and platform structure complement each other. The information structure is hierarchical. The lesson content gradually increases in difficulty, starting with a video containing the basic knowledge and followed by additional content and subsequent exercises.

- The **basics** are imparted by talking heads in *interactive videos*. The *moderator* (Helena Humphrey, Deutsche Welle anchor) first provides a *general overview* of the *chapter topic*, which will be elaborated on by *climate science experts* in the respective *lesson topic*. The expert videos *include quiz questions*.
- **Additional information**, mainly comprising *links* and *additional videos*, is included below the video.
- An **exercise, including a link to the lesson's own exercise forum** where participants can complete the exercise in writing, is assigned after a certain number of lessons with related content.

4.1. Look and feel: Visual structure of the course design

When learners access the platform, **clicking a link** will take them to the **course information page**, where they can enrol in the course free of charge once they have registered.

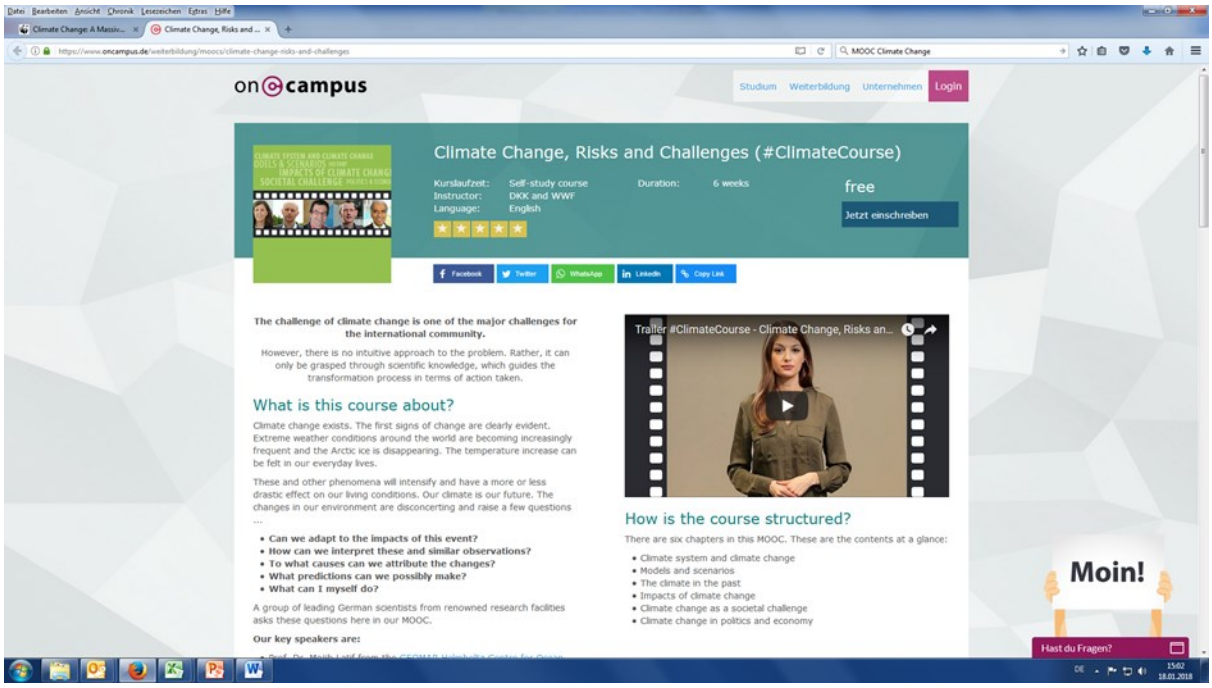

Fig. 2: Screenshot of the course information page of the #ClimateCourse on mooin, the MOOC platform (Link)

Structure of the course pages

Course context level (toolbar):

- **Course**. First item from the left on the toolbar: course content.
- **News**. New forum where organisers and administrators can post messages.
- **Participants**. A world map of the participants.
- **General discussions**. A general discussion forum.
- **Social media**. For the organisers to link social networks.
- **Badges and certificates**. A list of the available and awarded badges, and the option to retrieve the further education certificate.

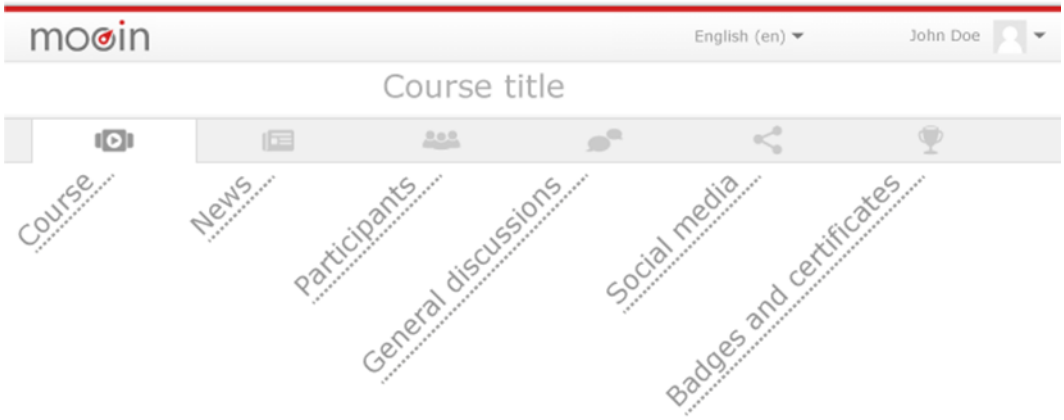

Fig. 3: Screenshot of the #ClimateCourse toolbar

Chapter outline level (visual chapter navigation using chapter graphics):

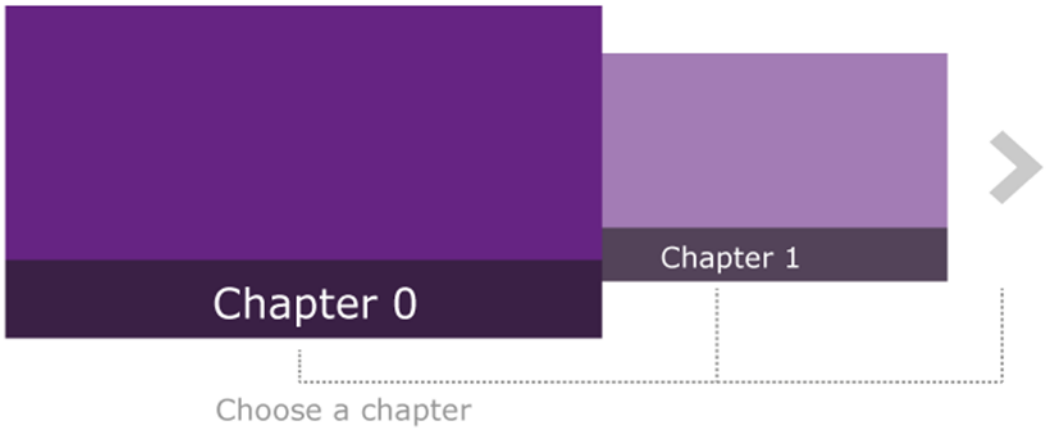

Fig. 4: Schematic representation of the #ClimateCourse chapter navigation

Lesson level (tabs):

Fig. 5: Schematic representation of the navigation within a #ClimateCourse chapter. Within a lesson: visual and functional structure achieved with coloured elements.

4.2. #ClimateCourse content

Altogether the #ClimateCourse consists of **an introductory chapter and six chapters of content**, each comprising **seven to 12 lessons**.

One key speaker each guides through one of the six chapters, the scientific key messages being based on the IPCC Fifth Assessment Report. A moderator guides participants throughout the whole course, overarching all chapters.

The six chapters of content develop the topic of climate change as follows:

Chapters 1–3:	Scientific background;
Chapter 4:	Impacts of climate change around the world; and
Chapters 5 and 6:	Social, political and economic aspects.

The individual chapters are structured as follows:

Chapter 0 – Organisation

Overview of the entire course content, the course structure and learning in the MOOC

Chapter 1 – Climate System and Climate Change

Lesson 1: Weather and climate – What is the difference?
Lesson 2: The climate system and its components
Lesson 3: How does the natural greenhouse effect work?
Lesson 4: The anthropogenic greenhouse effect
Lesson 5: The temperature trend since 1900
Lesson 6: Fossil fuels: the basis of our economy
Lesson 7: Where are emissions produced?
Lesson 8: Factors affecting emission trends
Lesson 9: Emission sources and consumption – value chain

Chapter 2 – Models and Scenarios

Lesson 1: Climate models – a glimpse into the future
Lesson 2: What is a climate model?
Lesson 3: Basis for climate model computations
Lesson 4: Major climate scenarios
Lesson 5: What does the climate look like in a warmer world?
Lesson 6: What is the meaning of a ‘2°C upper limit’?
Lesson 7: Drastic emission reduction in order to stay below 2°C
Lesson 8: Validity of the climate models
Lesson 9: The role of the Climate Panel (IPCC)

Chapter 3 – The Climate of the Past

Lesson 1: Climate witnesses of the past
Lesson 2: What information does science find in a core sample?
Lesson 3: From core sample to climate change in the past
Lesson 4: The cause of glacial and interglacial periods

4.3. #ClimateCourse key speakers

Prof. Dr Mojib Latif

GEOMAR Helmholtz Centre for Ocean Research, Kiel

Prof. Dr Mojib Latif is Head of the Ocean Circulation and Climate Dynamics research division at the GEOMAR Helmholtz Centre for Ocean Research Kiel.

He studied meteorology at Universität Hamburg. After obtaining his doctorate in oceanography, he was a private lecturer at the Max Planck Institute for Meteorology in Hamburg, before moving to Kiel in 2003. He is a co-author of the 2001 and 2007 IPCC reports.

Website: **www.geomar.de**

Prof. Dr Jochem Marotzke

Max Planck Institute for Meteorology, Hamburg

Prof. Dr Jochem Marotzke is Director at the Max Planck Institute for Meteorology (MPI-M), where he heads 'The Ocean in the Earth System' department, and professor at Universität Hamburg.

He studied physics at the universities of Bonn, Copenhagen and Kiel, and obtained his doctorate in Oceanography at Kiel. He worked on the Fifth Assessment Report (IPCC) in working group I, as coordinating lead author of the 'Evaluation of Climate Models' chapter and as lead author of the 'Technical Summary' and the 'Synthesis Report'.

Website: **www.mpimet.mpg.de**

Prof. Dr Michael Schulz

MARUM – Center for Marine Environmental Sciences, Bremen

Prof. Dr Michael Schulz studied geology at Kiel University and marine geotechnics at Bangor University in Wales. After earning his doctorate at Kiel University, he worked as a research assistant at Kiel University, at the Scripps Institution of Oceanography (USA) and at the Meteorological Institute at Universität Hamburg. He has been Professor for Geosystem Modelling at the University Bremen, heading MARUM, since 2001. In addition, he is Chairman of the Senate Commission on Oceanography of the Deutsche Forschungsgemeinschaft. He worked on the Fifth Assessment Report (IPCC) in working group I, as coordinating lead author of the 'Information from Paleoclimate Archives' chapter.

Website: **www.marum.de**

Prof. Dr Hermann Lotze-Campen

Potsdam Institute for Climate Impact Research (PIK), Potsdam

Prof. Dr Hermann Lotze-Campen studied agricultural sciences and economics at the universities of Kiel, Reading (UK) and Minnesota (USA). After obtaining his

doctorate from the Humboldt-Universität in Berlin, he worked for the InfoTerra development team at Astrium. He is Head of the Climate Impacts and Vulnerabilities PIK research domain II at the Potsdam Institute for Climate Impact Research (PIK), and Professor for Sustainable Land Use and Climate Change at the Humboldt-Universität in Berlin.

Website: **www.pik-potsdam.de**

Prof. Dr Anita Engels

CliSAP, Cluster of Excellence: Integrated Climate System Analysis and Prediction, Hamburg

Prof. Dr Anita Engels is Professor of Sociology at Universität Hamburg, specialising in globalisation, the environment and society, and spokeswoman for the Cluster of Excellence Integrated Climate System Analysis and Prediction (CliSAP). She is also a Member of the Executive Committee of the Center for Earth System Research and Sustainability (CEN) and of the Center for Globalization and Governance (CGG). She studied sociology at Bielefeld University.

Website: **www.wiso.uni-hamburg.de**

Website: **www.clisap.de**

Prof. Dr Gernot Klepper

Institute for the World Economy (IfW), Kiel
Prof. Dr Gernot Klepper is an environmental economist and Head of the Environment and Natural Resources research division at the Kiel Institute for the World Economy (IfW) at Kiel University.
He studied economics at Heidelberg University and later agricultural economics at the University of Kentucky, USA, where he obtained his doctorate in 1983. He was a Research Fellow at the Centre for Economic Policy Research (CEPR) in London from 1988 to 1994, and subsequently held various management positions at the IfW.

Website: **www.ifw-kiel.de**

Other **climate specialists**, from other disciplines too, present a more comprehensive view with their scientific expertise.

4.4. #ClimateCourse moderator

Helena Humphrey is an Anchor and Correspondent at Germany's global broadcaster Deutsche Welle TV.

She studied at the University of Nottingham, graduating with a degree in Modern Foreign Languages, before training as a journalist at the BBC Academy in London.

Helena has gathered many years of international experience both in journalism and in humanitarian work, as a former spokesperson for the Red Cross in West Africa, and an

employee at the United Nations in the Philippines. As a journalist, she has served as Presenter and News Editor at Radio France International in Paris and World Radio Switzerland in Geneva.

Preventing climate change has been a cause close to Helena's heart ever since she reported on the record breaking journey of the Solar Impulse plane across the United States.

5. #ClimateCourse teaching method

The course lessons include the following learning content and activities:

- title,
- interactive video,
- further reading material and
- learning activities in the forum.

The related teaching purpose is:

- **Title**: for orientation.
- **Video** on the basic knowledge relevant to the lesson, including **interactive, multiple-choice quiz questions**. These questions are integrated into the videos using H5P and are intended to direct attention to specific issues in order to avoid consumption of the videos in a purely passive manner, without cognitive activation. English subtitles are available to facilitate the understanding of non-native speakers. The subtitles were generated in YouTube specifically for this purpose.
- **Additional content**. This could include links to supplementary content in blogs, PDFs or animations. In addition, content generated by the WWF and DKK is available in the cloud (our ownCloud in the oncampus GmbH cloud).
- **Exercises** are set in individual lessons and can be completed in the respective exercise forums. This consolidates what has been learnt. Learners make their own contributions and comment on others' posts.

There are the following learning activities:

- **quiz questions** to answer in the videos;
- **discussions** about various topics in the general discussion forum; and
- **exercises to complete in the exercise forums**.

These vary by topic. Initially, the chapters are more concerned with the scientific aspect of climate science, primarily in relation to the analysis of man-made climate change. From Chapter 4 onwards, the topics are mainly based on socio-scientific research. The focus is on the impacts of climate change, possible solutions and practical relevance and knowledge.

5.1. Certificates, the further education certificate and Mozilla Open Badges

A **further education certificate** is automatically issued at the end of the course **if at least 80 per cent of all the quiz questions integrated into the videos are answered correctly**.

Mozilla Open Badges can also be earned. This **gamification** is intended as encouragement.

Actually, these badges are visual tokens of **micro-credentials** that can be stored in the Mozilla Backpack and embedded in LinkedIn profiles and personal websites to display the specific competences and interests.

Completing the supplementary exercises in the exercise forums is the **prerequisite for earning badges**. Fulfilment of this prerequisite is checked automatically:

For this purpose, participants must post at least one contribution and comment on two other posts per exercise. This is to ensure that the automated check is not evaded by merely typing in an 'X' in the forum, for example.

5.2. Content and target-group level

There are no entry requirements for this MOOC, and the tone is kept friendly and constructive in order to create a learning environment that is socially inclusive (low-threshold).

The course is in English with English subtitles to make comprehension easier. Non-native participants may also use the Google Translate service for their forum posts.
The key speakers and other experts, all leading, top scientists, present their specialist knowledge as comprehensibly as possible, yet at an ambitious scientific level, in the videos.

Heterogeneous international participants

Fig. 6: Screenshot of the #ClimateCourse map of participants

External MOOC participants generally show advanced knowledge in the field. Many of the students are either professionally involved or committed to relevant activities. In the University context motivation and prior knowledge of the participants are much more diverse.

6. How can the #ClimateCourse MOOC be used at universities?

Blended learning, which combines the benefits of both online and classroom teaching and learning, is ideal for universities. This must be designed accordingly.

6.1. General information for the use of the MOOC in university teaching

Essentially, we can use the **metaphor of an interactive textbook** to describe how external stand-alone courses can be incorporated into university teaching: after all, a book can be used both for self-learning and in classroom teaching.

Note: The #ClimateCourse has a Creative Commons Attribution-ShareAlike 4.0 International (CC BY-SA 4.0) licence[4] and can be entirely incorporated into a curriculum at any time. However, the use of parts of the content (such as single images from the videos) requires prior agreement with the organisers.

The #ClimateCourse can be used in a number of manners, since the climate issue concerns all areas of life and education. The fact that the **external participants of the English MOOC are international** should make this particularly attractive.

- Thus, students of all disciplines can practise their **English** while engaging in **high-level conversation on a specialist topic** with like-minded people.
- In addition to **discussing a globally relevant topic**, they also:
  - apply their **digital and intercultural competences**; and
  - get the **opportunity to network internationally**.

6.2. Who can incorporate the MOOC? And how?

It is not only at universities that the MOOC can be effectively used, but also at all other academic institutions in a variety of disciplines.

The course design serves **bachelor's and master's students of all disciplines** as a potential interdisciplinary subject and is equally suitable **for use in the humanities and in the natural sciences** due to the breadth of its content.

In order to **focus** on a specific aspect of the course, emphasis can be placed on either the **climate science topics in the first half of the course** for the strictly scientific aspect, or the **second half of the course (Chapters 4–6)** for the **social, political and economic aspects**.

The course serves as a good introduction to the core issues for **lawyers, political scientists, economists or journalists**, for example, wishing to specialise. They would probably benefit mostly from the **scientific topics**.

[4] Def.: "Creative Commons Attribution-ShareAlike license in international version 4, that allows to do what they want with your work as long as they **share the work under the same license**." Source

However, **scientific**, **engineering** and other **technical degree programmes** could be invariably enhanced with the topicality and internationality of the #ClimateCourse, firstly, due to its **global perspective**, and secondly, because **knowledge about the social, political and economic contexts is often neglected** in these specialised degree programmes. These can then be covered in this course.

6.3. How can the MOOC be incorporated?

The MOOC could be used as an **introductory course** for climate-related master's degree programmes. However, it could also be incorporated as an **elective or required module**, or, **the ideal scenario**, in a flexible manner as a **blended learning solution** within the existing semester curriculum.

6.3.1. Elective and compulsory modules

Elective and compulsory modules are intended to provide the opportunity to acquire core skills and broaden the subject matter with additional competences by providing content that is not related to the degree programme.

In addition to **elective modules**, suitable course elements that broaden the subject matter could become **required modules** necessary to attain the required number of credit points.

Online content such as the #ClimateCourse is always available.

- The self-learning **workload** is about one to two hours per chapter, that is, a total of six to 12 hours for the entire course. This, however, only refers to the lengths of the videos and does not include working with additional material or literature that is listed.
- Evidence of completion of the course for the **allocation of credit points** must be determined by the respective institute or university. In principle, the course's own further education certificate in conjunction with the Mozilla Open Badges could be used for this purpose. However, the drawback here is the automated check of participants' contributions.
- A **final examination** in traditional examination settings would provide the option of local validation. This would have to be organised and is therefore a more conceivable option for supervised use of the course.

6.3.2. Blended learning

The #ClimateCourse MOOC can be provided as a stand-alone, full-featured online course.

Combining this MOOC with classroom teaching would still be of great benefit. This integrative scenario became meanwhile more popular than pure classroom or online teaching.

'"Blended learning" designates the range of possibilities presented by combining Internet and digital media with established classroom forms that require the physical co-presence of teacher and students.'[5]

Blended learning or integrated learning is a form of learning that aims to combine classroom and e-learning (in this case the online course) in a didactically effective manner.

[5] Source: Norm Friesen "Defining Blended Learning": pdf

The flexibility of computer- or web-based self-learning content is combined with the social aspects of classroom teaching, which could add value. This combination can be effectively designed in various manners.[6]

A popular variation of blended learning is the inverted or flipped classroom.

Here, the sequence of presenting the content and subsequent learning , as can be found in the traditional classroom in conjunction with homework or even more so in lectures, is not really reversed (inverted or flipped) but otherwise distributed:

- Content that imparts the **basics** at the level of a traditional lecture should first be prepared in a **self-learning** situation, that is, it should be **self-organised** (online = independent of time and place).
- In a **subsequent classroom phase** these basics are supplemented, corrected and expanded through consultation, personalised feedback and in-depth reflection in the group. This is where the **teachers' expertise** comes into play: they use their greater knowledge to qualitatively mould the **students' specialist knowledge, which is now part of their basic knowledge**.
- **Both learners and teachers benefit from this**: students can plan their time more effectively based on what they have to learn; and teachers are faced with students who are prepared and can immediately discuss the topic in a more exhaustive and satisfying manner.

As opposed to stand-alone use of the online course, in the blended learning scenario all content can be aligned with the local study programme, including the appropriate examination.

There can be no optimal interaction without preparation. In this case, it would make sense to request that university teaching experts develop a blended learning design.

7. Two case studies and two field reports on the use of the #ClimateCourse

The #ClimateCourse was incorporated into an exploratory combination of online and classroom or supervised courses at two universities.

7.1. Case study 1 - The MOOC as an introductory course in a master's programme

The MOOC content was incorporated into 'Basic Research Skills', a required module for master's students at the School of Integrated Climate System Sciences (SICSS) at Universität Hamburg. On the basis of this course, students were in a better position to assess their other specialisations within the master's degree programme.

Target group:

- International, English-speaking
- Fourteen master's students at the Cluster of Excellence of the SICSS
- Between 23 and 36 years of age

[6] Further information: Graham Charles "Blended Learning Systems: Definition, Current Trends, and Future Directions", pdf

- Students with BSc degrees in various disciplines
- Heterogeneous prior knowledge related to climate science with a solid background in mathematics and physics

Degree programme:

Master's degree programme: ICSS – Integrated Climate System Sciences; first semester

Course content:

Basic research skills

Learning objectives:

- In their own interest, students had to select contacts relevant to them from among the international participants of the #ClimateCourse and network with them independently. In theory, the MOOC provides the best conditions. No appropriate supervision was provided.
- Acquisition of competences in basic studying skills. The learning activities were related to and conducted in parallel with the MOOC course content. This enabled participants to create presentations on individual elements of the course content. Therefore, the learning objectives with regard to the scientific method and the acquisition of basic research skills were achieved in the classroom rather than in the MOOC itself.
- Homogenisation of the prior knowledge of the international group of students with various bachelor's degrees.

The course was awarded with 3 ECTS credit points. The prerequisites for the credit points were participation in a collective presentation and a final examination, which included MOOC questions, was conducted locally and was supervised.
A survey on the acceptability of the online course and the use of the MOOC in the first semester of the degree programme of the Cluster of Excellence collected the following feedback:

General:

- The survey feedback reflects students' topical heterogeneity and high level of prior specialisation, as well as the lack of an explicitly communicated blended learning design.
- The favoured topics varied. The social and economic topics (Chapters 4–6) were particularly popular.
- The exercises of the MOOC are designed for easy knowledge transfer and not particularly to provoke discussions. Therefore, discussions and controversial topics should be included and guided in the classroom units to complete the learning experience.

With regard to the individual learning objectives:
Networking:

According to the students, hardly any of them took the opportunity to network. Individual feedback referred to the lack of a specific reason to network and the insufficient functionality of the forum.

Note:

Actually, the forum functionality on the mooin 'oncampus' learning platform is not optimised for social learning. Therefore, the learning objective of networking was either not possible without a specific reason or perhaps not even attempted.

In order to promote networking and international communication among students one could:

1. make networking an explicit learning objective, and create appropriate exercises that can be organised in a specifically created forum,
2. incorporate social media, communication channels and/or complementary stand-alone forum solutions and
3. provide educational assistance.

Homogenising the topically heterogeneous group

Not all students completed all the chapters. Individual feedback indicated that certain content was helpful for the local study programme. Other basic content was imparted later in the degree programme and quickly outpaced the MOOC basics. Consequently, the responsible parties at Universität Hamburg notified that the learning unit with the MOOC would be moved to the very beginning of the introductory course.

The MOOC is ideal for imparting basic knowledge to a heterogeneous group. More specific courses must be adjusted to the respective target group and organised in a complementary manner in the classroom.
In doing so, it is important that the learning objectives are generally transparent and that the didactic added value is clearly communicated.

7.2. Case study 2 – The MOOC in elective and required modules

The Technische Universität (TU) Berlin has a campus in El Gouna, Egypt, where the MOOC is an elective. The idea of its use here should serve as an example of the fact that the incorporation of MOOCs in teaching can initially also be quite informal in order to obtain first impressions of acceptability.

The El Gouna research campus functions as the scientific branch of the TU Berlin in Egypt, in the heart of the MENA region (Middle East and North Africa), and provides a fully equipped environment for study, research and development, as well as for cultural and scientific events.

As a research and development location, the campus is a state-of-the-art environment for the development of sustainable and applicable technologies to meet present and future challenges.

Target group:

The campus brings together the experts of the TU Berlin and the future professionals of the laboratory town of El Gouna.

Degree programmes:

The first master's degree programmes in energy engineering, urban development and waste engineering with practical training in sustainable technologies and development, and in climate change and the challenges for arid regions were introduced in 2012.

Learning objective:

The #ClimateCourse is intended to supplement the teaching in the above degree programmes and was first introduced in October 2017. All three departments offered the course as an elective. The course was introduced to the students as an important basic course at the beginning of the semester. The course was not supervised.

Learning:

The course is still in the exploratory trial stage and an elective. Participation cannot yet be credited. Accordingly, the enrolment figures were rather low.

However, based on experience, there are plans to offer the course as a required course worth 3 ECTS credits.

7.3. Summary of the results of the case studies

If a MOOC is to be incorporated into a classroom course, the content and learning processes must be didactically aligned and the interaction between the two formats clearly communicated to the users. Unavoidable differences can be specifically compensated for in the classroom setting.

A MOOC can be incorporated into a blending learning scenario at any time if these two fundamental aspects are taken into account. Ultimately, it is nothing more than an interactive textbook in which learners can also interact socially and consolidate what they have learnt in specialist discourse.

With regard to self-learning: selecting the learning platform should take into account that the technology and teaching method complement each other and that social learning is also given appropriate importance if the proportion of online learning is very large. Otherwise, social learning can always be shifted to the classroom setting, where the basics acquired through self-learning can be qualitatively processed in a group and/or individually.

7.4. The MOOC in journalism training – two field reports

In order to homogenise the basic knowledge of the heterogeneous target group of journalists, two more degree programmes have been using the MOOC in the context of blended learning in 2018: the Master's in Journalism and Mass Communication at Universität Hamburg and the bachelor's degree programme in Specialist Journalism at Ansbach University of Applied Sciences.

7.4.1 Master's in Journalism and Mass Communication, Universität Hamburg

The #ClimateCourse was used for about 10 students to address the topic of 'Climate Communication' in the master's degree programme in Mass Communication in the summer 2018 semester. Interest in the MOOC and the reason for its use was to meet the needs of

journalism students to acquire basic knowledge about climate change and to establish a common understanding of this complex subject area. Prof. Brüggemann considers the #ClimateCourse a course with high-calibre content and very good experts, and thus a good opportunity for the acquisition of solid basic knowledge. There are plans to use the MOOC again.[7]

7.4.2 Bachelor's degree programme in Specialist Journalism, Ansbach University of Applied Sciences

The German KlimaMOOC "Der Klimawandel und seine Folgen" (the original German version of the #ClimateCourse) was used in the degree programme in Specialist Journalism at Ansbach University of Applied Sciences in the summer 2018 semester. The target group for the MOOC was six to 14 students specialising in the environment and energy (in semesters 4 and 6). While searching for an additional course for the degree programme in Specialist Journalism, programme head Prof. Walter first completed the MOOC herself and then put together a curriculum based on the blended learning approach: "I was impressed by the MOOC's content, didactic concept and structure." In particular, the professor mentioned that her students could directly monitor their learning progress through the interactive questions and consolidate various aspects in the forums. Student feedback was consistently positive and mentioned the successful balancing act of acknowledged experts, low-threshold topic introduction, choice of supplementary material and, in particular, the entertaining but informative videos.

Prof. Walter would also permanently implement the course in the curriculum (as part of a blended learning event with a total of 4 contact hours per week and 5 ECTS credits). However, Prof. Walter said that this would depend on whether the content of the German version (primarily, the supplementary material) will be updated at suitable intervals.[8]

8. Prospects

The case studies demonstrate that an experimental approach is definitely worthwhile. They could contribute to the development of a tailored local teaching and learning scenario by combining an external online course—in this case, the MOOC—and a local classroom setting.

Consider the MOOC an additional 'high-level scientific textbook' that you can incorporate into your teaching. Extend your learning content with a modern learning programme that can be aligned to the prior knowledge, expectations and needs of the target group, and that helps supplement and personalise additional information in the classroom, as in flipped learning.

Interacting with the learners remains a challenge. As long as the forums are unsupervised, learners will not have the opportunity for in-depth specialist discussion. But neither does this halt progress. There are new platforms, next-generation learning environments for SPOCs (Small Private Online Courses). However, there are also MOOCs that have identified this weakness. An example of the latter is Curatr from HT2Labs. Here, social learning, joint curating and peer reviews are the main aspects of the learning experience. User-generated content can even be in the form of a video. If universities want to set up their own MOOC or course platform, they will look at newer technologies that take better account of modern teaching and learning requirements.

[7] Responsible for the course: Prof. Dr. Michael Brüggemann. If interested the syllabus of this course can be requested under: info@klima-konsortium.de
[8] Responsible for the course: Prof. Dr. Ismeni Walter. If interested, the syllabus of the course (only available in German!) can be requested under: info@klima-konsortium.de

The rapidly changing knowledge landscape of the 21st century requires flexible curricular adaptation measures. Often, universities due to internal regulations, cannot react as quickly as necessary — we need only think of the thematic area of climate change here.

The use of external web-based learning programmes that fulfil the qualitative requirements for academic use in terms of content and also serve the growing didactic needs of online teaching is likely to increase.

We want to encourage the pragmatic and experimental advancement of the digitisation of university teaching. This creates added value on two levels: on the one hand, the emerging generations of experts are already using the working practices required for a globally networked community and, on the other hand, new, high-quality, digital learning content (in this case, climate science) can be established more rapidly at universities without having to train teaching staff as much as usual. Often enough, the local classroom can neither of them put into practice.

We would like to take this opportunity to expressly thank the two participating universities, Universität Hamburg and the TU Berlin, not only for taking the relevance of the climate issue seriously, but also for their unbiased involvement in the 'MOOC in the academic context' project, driven by an interest in scientific knowledge for the benefit of modern teaching.

May many others follow their example.

9. Annex

Title	Module description **Massive Open Online Course:** **Climate Change, Risks and Challenges – #ClimateCourse**
Instructor	*Name of lecturer + institution*
Key speakers	• Prof. Dr Mojib Latif, GEOMAR Helmholtz Centre for Ocean Research, Kiel • Prof. Dr Jochem Marotzke, Max Planck Institute for Meteorology, Hamburg • Prof. Dr Michael Schulz, MARUM – Center for Marine Environmental Sciences, Bremen • Prof. Dr Hermann Lotze-Campen, Potsdam Institute for Climate Impact Research (PIK), Potsdam • Prof. Dr Anita Engels, Cluster of Excellence: Integrated Climate System Analysis and Prediction (CliSAP), Hamburg • Prof. Dr Gernot Klepper, Institute for the World Economy (IfW), Kiel
Topics	Climate, climate system, climate change, models and scenarios, sustainability, impacts of climate change, climate change as a societal challenge, economic prerequisites for a low carbon society
Language	English

Scope and overarching learning objectives	• This course explains the scientific basis of climate change and the impacts on nature and society, and identifies potential solutions
	• The participants will be encouraged to:
	  ○ learn more about the core principles of the climate system and the increasing human impact on the climate system
	  ○ understand the scientific method of working and arguing
	  ○ become aware of the causes and consequences of anthropogenic climate change, and identify action strategies at both the individual and the societal level
	  ○ distinguish between interest-oriented information and science-based knowledge

Learning objectives and content	**Chapter 1: 'Climate System and Climate Change' (Key speaker: Prof. Dr Mojib Latif, GEOMAR, Kiel)** • Define weather, climate, the climate system • Differentiate between natural and anthropogenic influences on the climate system • Name sources of anthropogenic greenhouse gas emissions (in particular, fossil fuels), factors that influence emission trends and underlying causes (lifestyle, growth) • Identify needs and constraints of the value chain Other speakers: Dr Paul Becker, German Meteorological Service, Offenbach Dr Sonja Peterson, Institute for the World Economy (IfW), Kiel Dr Ruth Delzeit, Institute for the World Economy (IfW), Kiel **Chapter 2: 'Climate Models and Scenarios' (Key speaker: Prof. Dr Jochem Marotzke, Max Planck Institute for Meteorology, Hamburg)** • Describe why we need climate models and how they work • Differentiate between the main climate scenarios for the 21st century and the climate change in the various scenarios • Identify the 2°C target as a political target and the ways to reach this target • Explain the carbon budget and its relation to the climate • Describe the role and function of the IPCC Other speakers: Dr Marco Giorgetta, Max Planck Institute for Meteorology, Hamburg Dr Tatiana Ilyina, Max Planck Institute for Meteorology, Hamburg Dr Christiane Textor, IPCC Coordination Office, Bonn **Chapter 3: 'Climate History' (Key speaker: Prof. Dr Michael Schulz, MARUM, Bremen)** • Explain the importance of reconstructing the climate of the past (Pleistocene and Holocene) and the role of drill cores • Identify the anthropogenic impact in younger climate history and the role of an increase in CO_2 • Indicate the cause of glacial and interglacial periods • Recognise the correlation between CO_2 concentration and global temperature • Describe the relationship between climate change and cultural history Other speakers: Dr Ute Merkel, MARUM – Centre for Marine Environmental Sciences, Bremen Prof. Dr Gerald Haug, Max Planck Institute for Chemistry, Mainz **Chapter 4: 'Impacts of Climate Change' (Key speaker: Prof. Dr Hermann Lotze-Campen, PIK, Potsdam)** • Describe the impacts of climate change on nature and society, and on our personal environment, particularly the specific challenges in urban areas and the impacts of climate change on oceans • Describe the concept and implication of the IPCC risk definition • List the risks of sudden and irreversible changes and describe the urgency to act • Explain the increase in extreme events • Describe the special role of urban climate in both adapting to climate change and mitigating greenhouse gas emissions Other speakers: Prof. Dr Ulf Riebesell, GEOMAR Helmholtz Centre for Ocean Research, Kiel Dr Tobias Geiger, Potsdam Institute for Climate Impact Research (PIK), Potsdam Dr Diego Rybski, Potsdam Institute for Climate Impact Research (PIK), Potsdam Interview partners: Prof. Dr Christoph Schneider, Humboldt University of Berlin, Berlin Prof. Dr Srinivasan, Indian Institute of Science, Bangalore Dr Chris Dickens, International Water Management Institute , Pretoria

	Chapter 5: 'Climate Change as a Societal Challenge' (Key speaker: Prof. Dr Anita Engels, CliSAP, Hamburg) • Explain the significance of human influence on climate for our society and the challenges for society, and list approaches for more climate protection • Describe the adaptation to climate impacts and its limitations • Explain the relationship between resource conflicts, migration and climate change Other speakers: Prof. Dr Beate M. W. Ratter, Cluster of Excellence Integrated Climate System Analysis and Prediction (CliSAP), Hamburg Prof. Dr Jürgen Scheffran, Cluster of Excellence Integrated Climate System Analysis and Prediction (CliSAP), Hamburg Prof. Dr Michael Brzoska, Cluster of Excellence Integrated Climate System Analysis and Prediction (CliSAP), Hamburg **Chapter 6: 'Climate Change in Politics and Economy' (Key speaker: Prof. Dr Gernot Klepper, IfW, Kiel)** • Describe the issues of international climate politics and the economy • List the main achievements of international climate politics • Describe the history of climate negotiations (COPs) • Explain the reasons why we must limit global warming well below 2°C and possible strategies towards a zero emission economy (for example, energy transition) Other speakers: Prof. Dr Hermann Held, Cluster of Excellence Integrated Climate System Analysis and Prediction (CliSAP), Hamburg Interview partners: Prof. Dr Beate M. W. Ratter, Cluster of Excellence Integrated Climate System Analysis and Prediction (CliSAP), Hamburg Prof. Dr Ottmar Edenhofer, Technical University of Berlin, Berlin Matthias Kopp, WWF Germany Lisa Weinhold, netzwerk n, Germany

Learning and teaching methods	Free and open online course with video lectures, interactive questions, additional materials, background information texts, competency-based badges, interdisciplinary and collaborative learning, online forum discussion, connecting on social media
Time frame	Enrolment possible at any time
Workload	Flexible: from five to 90 hours online, depending on additional materials and homework activities; no classroom attendance required Collaborating universities can set up additional classroom sessions
Exam	Open Badges and a training certificate.