ELIC CURRICULUM

MODULE 1: INTRODUCTION

a) **What is a MOOC**
(basics, advantages, disadvantages, general structure and aims, why should I participate, what can I expect)?

b) **The ELIC MOOC**
(specific structure/timetable and learning objectives, attendance and certification rules, presenting each other / participants and trainers get in touch)

c) **Getting started TOGETHER with "Engineering Literacy"**
(what is engineering literacy + first activities to get comfortable)

GENERAL DESCRIPTION OF THE MODULE

The first module aims at giving a general introduction to MOOC methodology, structure and requirements to get used to this online learning space and to understand how the ELIC MOOC is structured. This includes for example an overview of contents as well as the amount of time required to complete the course.
The participants thus will get an insight into the MOOC itself, the people involved in it and the topics that will be covered in each of the following weeks. Once familiar with this online learning space, participants will be asked to introduce themselves as a way of getting to know each other. A general look at the concept of engineering literacy will be taken, in order to start some reflections on how to promote it through innovative training methods as well as to practice how to work on e-tivities which are going to be implemented throughout the whole course.

LEARNING OBJECTIVES AND DESIRED COMPETENCES OF THE MODULE

- understand the aims and objectives of a MOOC
- get to know facilitators, fellow participants and plan personal participation
- gain an insight into engineering literacy by means of a short introduction
- understand how to use ELIC MOOC for official final skills' certification

LENGTH OF THE MODULE

1 module is equal to 1 MOOC week – the required effort will reach **approximately 6 hours.** This module will start on the **3rd of february and ends on the 9th of february 2019**.

TARGET GROUPS OF THE MODULE

Two main target groups have been identified for this module, so for the entire MOOC:
A: Teacher of STEM-subjects for secondary school pupils (General Secondary School)
B: Teacher of STEM-subjects for secondary school pupils (Natural Science Specialisation of Secondary School)

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With the selected target groups and the didactical approach applied, the ELIC project makes sure that secondary school teacher will be equipped with the adequate tools to present engineering topics in classes in an appealing way to students while acting as multipliers and increasing the interest of engineering topics among the secondary target group of pupils.

PRE-REQUISITES FOR THE MODULE

• Interdisciplinary thinking
• Well-founded knowledge in at least one of the following STEM subjects (European Qualification Framework (EQF)-Level 6-8:

- Mathematics - Physics - Chemistry - Biology - Informatics - Technology	- Computer Sciences - Biochemistry - Mechanics - Electronics - Software - Renewable Energies

- Teaching skills for STEM topics
- Interest in broadening knowledge and skills

TEACHING AND LEARNING CONCEPT OF THE MODULE

Different types of online teaching and learning channels were defined. They will be available in the MOOC and are explained below:

Quizzes – Checking the learning objectives through games or mind sports
Video tutorials – Transferring the content of the module through videos

DETAILED INFORMATION ON THE TOPICS

	What is a MOOC ?
LENGTH OF THE TOPIC	2 hours
LEARNING CONTENTS	- Basic definition of a MOOC - What are the advantages & disadvantages of a MOOC - general structure, aims and rules - why should I participate - what can I expect
TEACHING METHODS	As this module is about introducing the general use and objectives of a MOOC, participants should become interested and "warum-up". The methodology is made up of videos and daily postings as well as additional readings.
OUTCOME	After working on this topic, the participants should: - be able to explain what a MOOC is

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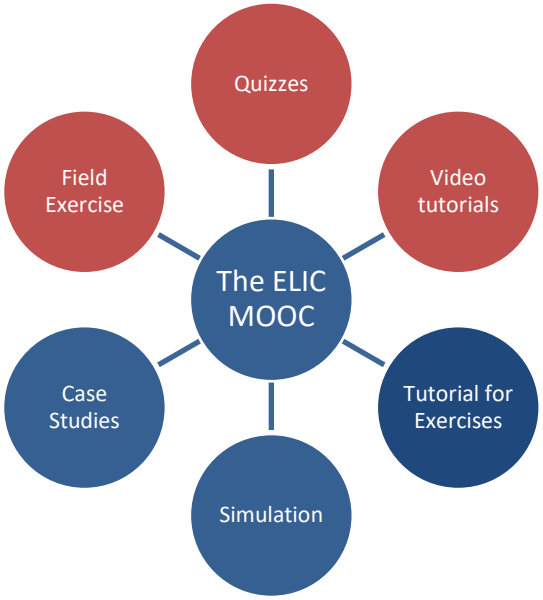
	- understand the aims and objectives of a MOOC - understand the advantages and disadvantages of learning in a MOOC - understand the approach of obtaining skills in a MOOC - be able to participate in the following modules (having rules and standards)

TOPIC	**The ELIC MOOC**
LENGTH OF THE TOPIC	4 hours
LEARNING CONTENTS	• short introduction to the project (ELIC video) • specific structure/timetable and ELIC materials • learning objectives to each module • attendance and certification rules • presenting each other / participants and trainers/moderators/facilitators get in touch
TEACHING METHODS	
OUTCOME	After working on this topic, the MOOC participants should: • know the aims and objective of the ELIC project in general as well as of the ELIC MOOC • know each module´s content and structure including timetable • be in touch with the involved trainers, moderators and facilitators and some of the participants • be interested in participating because of the fitting objectives and clear understandable structure

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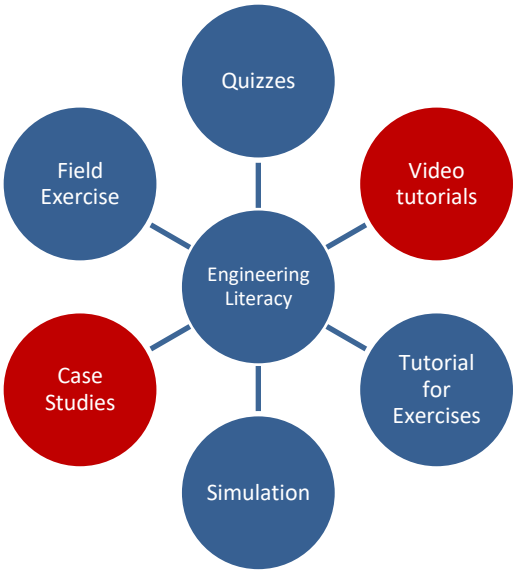
	• be able to clarify self-motivation • be able to understand the approach for obtaining the ELIC certification • be able to plan a personal timetable approach.

TOPIC	**Getting started TOGETHER with "ENGINEERING LITERACY"**
LENGTH OF THE TOPIC	2 hours
LEARNING CONTENTS	- What is engineering literacy? How is it defined? - Why is it important to foster engineering literacy in secondary schools?
TEACHING METHODS	
OUTCOME	After working on this topic, the participants should be able: • to broadly understand the term Engineering Literacy • to network with other participants and identify commonalities in their training ativities • to identify potential areas where to promote engineering literacy

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MODULE 2: BATTERY & LIGHT SYSTEMS

a) Battery Systems
b) Light Systems

GENERAL DESCRIPTION OF THE MODULE

Reference to ELIC Skill Card: ELIC.U2.E1 and ELIC.U2.E1 and

The goal of the module 2 is to introduce the teachers to how headlamps and rear lamps are used in cars and to provide a system engineering understanding which allows teachers to assign experiments at school and content learned at school to specific Automotive functionalities.
Another goal of this module is to introduce the teachers to how the battery systems are implemented into modern vehicles. It should provide an overall understanding of how the field of knowledge from various science areas can be applied to modern vehicle battery systems.

LEARNING OBJECTIVES AND DESIRED COMPETENCES OF THE MODULE

The aim of the module is to introduce the teachers to some very current engineering topics and to give them a hint on how they can be introduced to the set teaching curriculum, combining the content with the required standard of STEM-subjects. The teachers should understand the basic functionalities behind the technologies and forge their own opinion regarding these topics. Therefore, the learning objectives are:

- Knowing, understanding and teaching the basics of Battery systems
- Knowing, understanding and teaching the basics of Lighting systems

Reference to ELIC Skill Card: Performance Criteria

ELIC.U2.E1.PC1 Understanding the system engineering concept of the Lithium Ion battery system in cars.
ELIC.U2.E1.PC2 Knowing how physics experiments and knowledge taught in schools can be mapped onto the battery system.
ELIC.U2.E1.PC3 Knowing how chemistry experiments and knowledge taught in schools can be mapped onto the battery system.
ELIC.U2.E1.PC4 Knowing how mathematics taught in schools can be mapped onto the battery system.
ELIC.U2.E1.PC5 Knowing how informatics taught in schools can be mapped onto the battery system.
ELIC.U2.E1.PC6 Knowing how biology and environmental issues taught in schools can be mapped onto the battery system.
ELIC.U2.E1.PC7 Knowing how ethics taught in schools can be mapped onto the battery system.

LENGTH OF THE MODULE

1 module is equal to 1 MOOC week – so the length of the module will be 1 week.

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TARGET GROUPS OF THE MODULE

Two main target groups could be identified for this module:
A: Teacher of STEM-subjects for secondary school pupils (General Secondary School) B: Teacher of STEM-subjects for secondary school pupils (Natural Science Specialisation of Secondary School) With the selected target groups and the didactical approach applied, the ELIC project makes sure that secondary school teacher will be equipped with the adequate tools to present engineering topics in classes in an appealing way to students while acting as multipliers and increasing the interest of engineering topics among the secondary target group of pupils.

PRE-REQUISITES FOR THE MODULE

Well-founded knowledge in STEM subjects (European Qualification Framework (EQF)-Lev-el 6-8:

- Mathematics
- Physics
- Chemistry
- Biology
- Informatics
- Technology
- Computer Sciences
- Bio-chemistry
- Mechanics

TEACHING AND LEARNING CONCEPT OF THE MODULE

DETAILED INFORMATION ON THE TOPICS

TOPIC	**Overview of battery systems and their elements**
LENGTH OF THE TOPIC	4 hours
LEARNING CONTENTS	•History of implementation of battery systems into vehicles •Basic terms, basic concepts •Overview of different battery types and their properties •Most common types of battery types used in automotive applications ➢ Transferring that system concept knowledge to the different STEM courses taught in school.
TEACHING METHODS	
OUTCOME	•After working on this topic, the teacher should be able: •Explain the history of usage of batteries in vehicles

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	•Explain the basic functional concepts of batteries used in vehicle applications •Explain the chemical concepts of various battery types •Knowing how: Chemistry, Biology and Environmental issues, Physics, Technology taught in schools can be mapped onto battery systems.

TOPIC	**Overview of battery systems and their elements 2**
LENGTH OF THE TOPIC	4 hours
LEARNING CONTENTS	•Battery management systems •Communication protocols within the BMS and with other vehicle systems •Protection of battery cells •Failure modes ➢ Transferring that system concept knowledge to the different STEM courses taught in school.
TEACHING METHODS	
OUTCOME	•After working on this topic, the teacher should be able: •Explain the concepts of battery management systems •Explain common communication protocols •Explain basics of protection of vehicle battery systems •Knowing how: -Informatics, Physics, Mathematics, Technology taught in schools can be mapped onto battery systems.

TOPIC	**Overview of battery systems and their elements 3**
LENGTH OF THE TOPIC	2 hours
LEARNING CONTENTS	•Testing vehicle battery systems •Storage and disposal of batteries •Safety ➢ Transferring that system concept knowledge to the different STEM courses taught in school.
TEACHING METHODS	
OUTCOME	•After working on this topic, the teacher should be able: •Explain testing vehicle battery systems •Explain the fundamental safety when handing

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	batteries •Knowing how: -Physics, Biology and Environmental issues, Technology taught in schools can be mapped onto battery systems.

TOPIC	**AFS (Advanced Front Lighting)**
LENGTH OF THE TOPIC	4 hours
LEARNING CONTENTS	•History •Legislation •Principles •Camera based systems ➢ Transferring that system concept knowledge to the different STEM courses taught in school.
TEACHING METHODS	
OUTCOME	After working on this topic, the teacher should be able: -Explain AFS principles -Explain how camera-based systems works -Explain the failure modes which need to be controlled in the car -Explain the interfaces between headlamp and the car •Knowing how: -Informatics, Physics, Mathematics taught in schools can be mapped onto controlling electric lighting system.

TOPIC	**Headlamp and rear lamp opto mechatronic systems**
LENGTH OF THE TOPIC	4 hours
LEARNING CONTENTS	•Light sources overview •Basics of optical concepts •Basics of electrical power concepts •Faults that lead to hazardous driving situations and how to avoid the faults (software, sensors, electronic)

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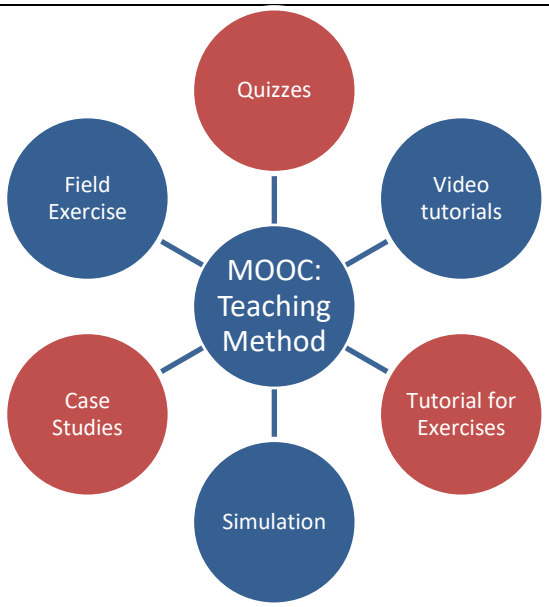
TEACHING METHODS	
OUTCOME	•After working on this topic, the teacher should be able: -Explain how a headlamp works -Explain common light sources their pros and cons -Explain power concepts and their pros and cons -Know the main Physical Principles which can be mapped to the school subjects of STEM teachers

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MODULE 3: COMBUSTION ENGINE

(1) Engine-mechanics
(2) Fuels for engines
(3) Mixture formation and combustion
(4) Exhaust gases and aftertreatment
(5) Social and environmental impact

GENERAL DESCRIPTION OF THE MODULE

The aim of this module is to give an introduction to the operation of internal combustion engines and the impact to society and environment. The working process of the internal combustion engine has been divided into 5 topics. In “engine-mechanics” the basic function of a 4-stroke-engine is described and the main parts are introduced. In “fuels for engines” different possibilities of current and advanced fuels are discussed. “Mixture formation and combustion” will highlight the transformation of chemical energy to mechanical energy. The last two topics deal with emission, there reduction in aftertreatment systems and the impact of exhaust gas immission.

LEARNING OBJECTIVES AND DESIRED COMPETENCES OF THE MODULE

- To understand the basic function of internal combustion engines
- To know about exhaust gases and why they occur
- To know how exhaust gases can be reduced
- To have information about health effects and effect to global warming

ELIC.U2.E3.PC1	- Understanding the system engineering concept of the combustion engine in cars.
ELIC.U2.E3.PC2	- Knowing how physics experiments and knowledge taught in schools can be mapped onto the combustion engine system
ELIC.U2.E3.PC3	- Knowing how chemistry experiments and knowledge taught in schools can be mapped onto the combustion engine system.
ELIC.U2.E3.PC4	- Knowing how mathematics taught in schools can be mapped onto the combustion engine system.
ELIC.U2.E3.PC5	- Knowing how informatics taught in schools can be mapped onto the combustion engine system.
ELIC.U2.E3.PC6	- Knowing how biology and environmental issues taught in schools can be mapped onto the combustion engine system.
ELIC.U2.E3.PC7	- Knowing how ethics taught in schools can be mapped onto the combustion engine system.

LENGTH OF THE MODULE

The module is equal to 1 MOOC week – the lenth of this module will be approximately 5 hours.

TARGET GROUPS OF THE MODULE

Two main target groups have been identified for this module:

(1) Teachers of STEM-subjects for secondary school pupils (General Secondary School)
(2) Teachers of STEM-subjects for secondary school pupils (Natural Science Specialisation of Secondary School)

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With the selected target groups and the didactical approach applied, the ELIC project aims to equip secondary school teachers with the adequate tools to present engineering topics in classes in an appealing way to students, while acting as multipliers and increasing the interest in engineering topics amongst pupils.

PRE-REQUISITES FOR THE MODULE

The pre-requisite for this module is having attended the introduction week of the ELIC MOOC.

TEACHING AND LEARNING CONCEPT OF THE MODULE

This module applies numerous teaching methods. The conclusion will be mainly assisted by questionnaires. However, it will also ask for feedback in free-writing style in order to not restrict the freedom of expressing any opinion on the MOOC. Further videos that recaps all main contents and important topics will be produced – still it will not be possible to answer the questions only by watching the videos.

DETAILED INFORMATION ON THE TOPICS

TOPIC	**Combustion Engine Mechanics**
LENGTH OF THE TOPIC	1.5 hours

LEARNING CONTENTS	- Introduction
	- Mechanics of combustion engines
	- Main components of combustion engines:
	  ○ Crank case
	  ○ Cylinder head
	  ○ Crank shaft
	  ○ Connecting rod
	  ○ Piston + rings
	  ○ Valve train
	  ○ Intake system
	  ○ Exhaust system
	  ○ Aftertreatment
	  ○ Cooling
	  ○ Auxiliaries

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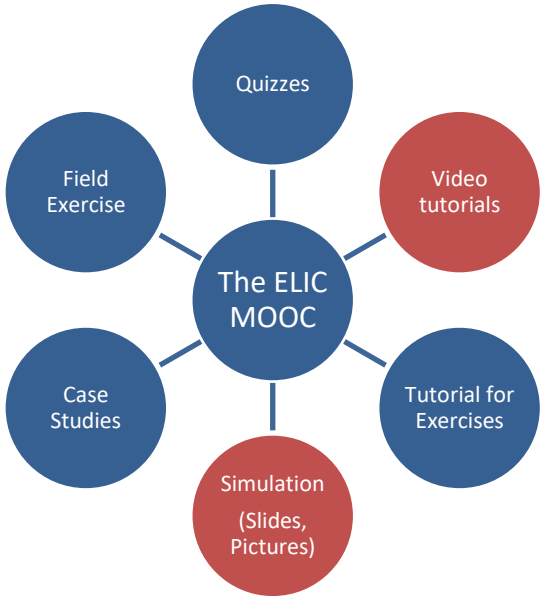
TEACHING METHODS	
OUTCOME	After working on this topic, teachers should - understand the components and basic functions of internal combustion engines - be able to explain the mechanics of a combustion engine - know how STEM subjects can be linked to combustion engines through exercises

TOPIC	**Fuels for engines**
LENGTH OF THE TOPIC	0.5 hours

LEARNING CONTENTS	- Different engine types defined by fuel
	  ○ Gasoline (spark ignited)
	  ○ Diesel (compression ignited)
	  ○ CNG
	- Overview of different fuels and their usage
	- Fuel properties and chemical formulas of fuels
	  ○ Gasoline (spark ignited)
	  ○ Diesel (compression ignited)
	  ○ CNG
	  ○ Alcohols
	- Environmental aspects
	- Outlook – Future of fuels

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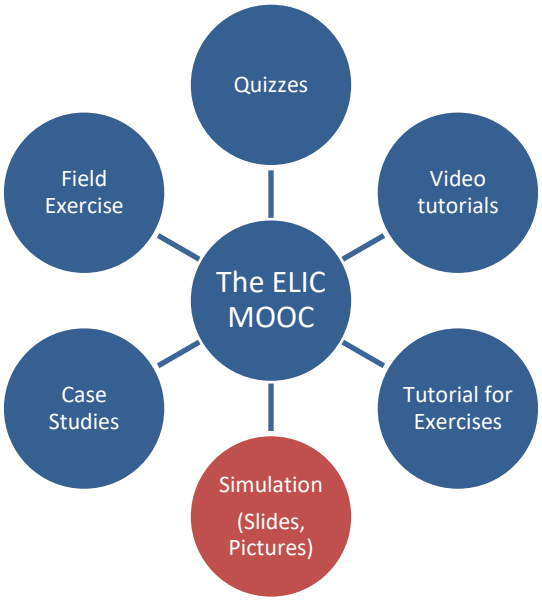
TEACHING METHODS	
OUTCOME	After working on this topic, teachers should - know about different engine types - be able to understand different fuel properties and usage - have an overview of environmental aspects regarding various fuel types and future prospects - know how STEM subjects can be linked to fuels through exercises

TOPIC	**Mixture formation and combustion**
LENGTH OF THE TOPIC	1 hour

LEARNING CONTENTS	- Injection systems
	  ○ Spark ignited
	  ○ Compression ignited
	  ○ CNG
	- Mixture formation parameters
	- Basics of combustion processes
	  ○ Comparison Spark ignited vs. compression ignited

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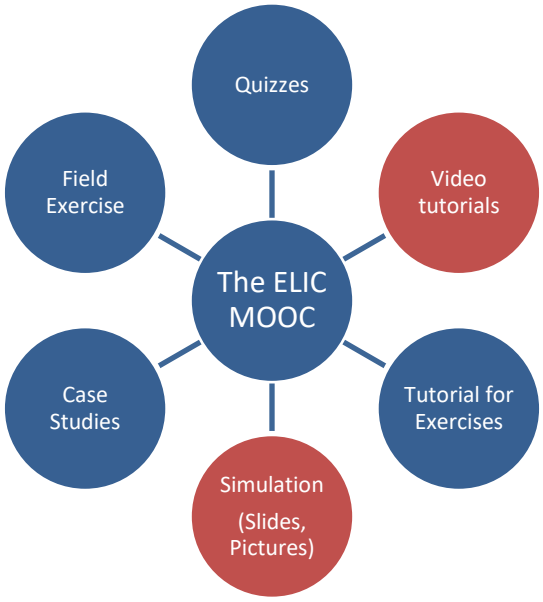
TEACHING METHODS	
OUTCOME	After working on this topic, teachers should - Understand different ignition systems - Be able to explain the differences between spark ignited and compression ignited combustion processes - Know how STEM subjects can be linked to combustion processes

TOPIC	**Exhaust gases and aftertreatment**
LENGTH OF THE TOPIC	1 hour

LEARNING CONTENTS	- Introduction
	- Composition of exhaust gases
	- Possibilities for the reduction of exhaust gases
	  ○ Spark ignited
	  ○ Compression ignited

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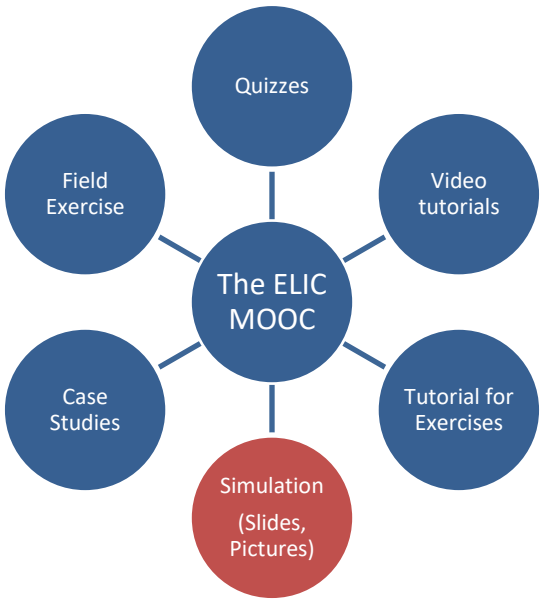
TEACHING METHODS	
OUTCOME	After working on this topic, teachers should - understand the composition of exhaust gases - be informed about measures to reduce exhaust gases - know how STEM subjects can be linked to exhaust gases and their aftertreatment

TOPIC	**Social and environmental impact**
LENGTH OF THE TOPIC	1 hour
LEARNING CONTENTS	- Advantages/disadvantages of internal combustion engines - Emission vs. Immission - Impact of exhaust gases on environment (plants, animals) - Impact of exhaust gases on society (humans) - CO_2 greenhouse gas: CO_2 neutral or CO_2 free? - Zero emission demand? - Outlook

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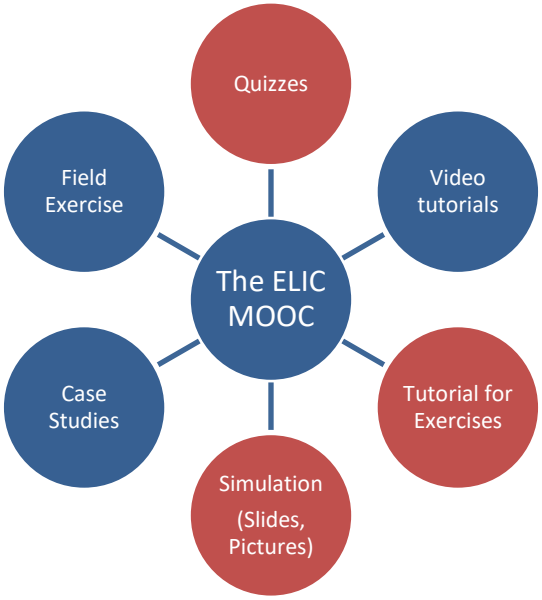
TEACHING METHODS	
OUTCOME	After working on this topic, teachers should - know about the impact of combustion engines - be able to discuss about CO_2 neutrality vs. CO_2 free engines with the pupils - know how STEM subjects can be linked to the impact of combustion engines on society and environment via exercises

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MODULE 4: E-MOTOR

a) E-Motor
b) Electric Drive
c) Hybrid Drive

GENERAL DESCRIPTION OF THE MODULE

Reference to ELIC Skill Card: ELIC.U2.E4

The goal of the module 4 is to introduce the teachers to how electric motors are used in cars and to provide a system engineering understanding which alows teachers to assign experiments at school and content learned at school to specific Automotive functionalities.

LEARNING OBJECTIVES AND DESIRED COMPETENCES OF THE MODULE

The aim of the module is to introduce the teachers to some system componenents, system elements and interfaces in powertrain solutions in cars where e-motor concepts are used. It gives hints on how the components work in cars and offering hints about how to assign specific knolwedge leraned at schools to those vehicle functions and components.
ELIC is appying the ECQA (European Certification and Qualification Association) and EQF (European Qualification Framework) schema to describe necessary skills.

Reference to ELIC Skill Card: Performance Criteria (What a leraner is able to perform)

ELIC.U2.E4.PC1	Understanding the system engineering concept of the e-motor in cars.
ELIC.U2.E4.PC2	Knowing how physics experiments and knowledge taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC3	Knowing how chemistry experiments and knowledge taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC4	Knowing how mathematics taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC5	Knowing how informatics taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC6	Knowing how biology and environmental issues taught in schools can be mapped onto the e-motor in cars.
ELIC.U2.E4.PC7	Knowing how ethics taught in schools can be mapped onto the e-motor in cars.

LENGTH OF THE MODULE

1 module is equal to 1 MOOC week – so the length of the module will be 1 week.

TARGET GROUPS OF THE MODULE

Two main target groups could be identified for this module:
A: Teacher of STEM-subjects for secondary school pupils (General Secondary School)

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B: Teacher of STEM-subjects for secondary school pupils (Natural Science Specialisation of Secondary School) With the selected target groups and the didactical approach applied, the ELIC project makes sure that secondary school teacher will be equipped with the adequate tools to present engineering topics in classes in an appealing way to students while acting as multipliers and increasing the interest of engineeringtopics among the secondary target group of pupils.

PRE-REQUISITES FOR THE MODULE

Well-founded knowledge in STEM subjects (European Qualification Framework (EQF)-Level 6-8:

- Mathematics
- Physics
- Chemistry
- Biology
- Informatics
- Technology
- Computer Sciences
- Biochemistry
- Mechanics

TEACHING AND LEARNING CONCEPT OF THE MODULE

Seven different types of online teaching and learning channels were defined. They will be available in the MOOC and are explained below:
Quizzes – Checking the learning objectives through games or mind sports
Video tutorials – Transferring the content of the module through videos
Tutorial for exercises – Description for exercises in form of short videos
Simulations – Learning the objectives of the content through simulating the technical principles
Case Studies – "Cases" will be used to develop solutions for problems regarding the technical background of the topic
Field Exercises – Practical examples and exercises from the industry

DETAILED INFORMATION ON THE TOPICS

TOPIC	**Electric Drive and System Concept**
LENGTH OF THE TOPIC	8 hours and 8 hours Exercise
LEARNING CONTENTS	•Electric Drive Train (System Functions and Concept) •Hybrid Systems (System Functions and Concept) •Problems to Solve and Manage in Car Solutions •Basics Controls and Principles Applied ➢ Transferring that system concept knowledge to the different STEM courses taught in school.

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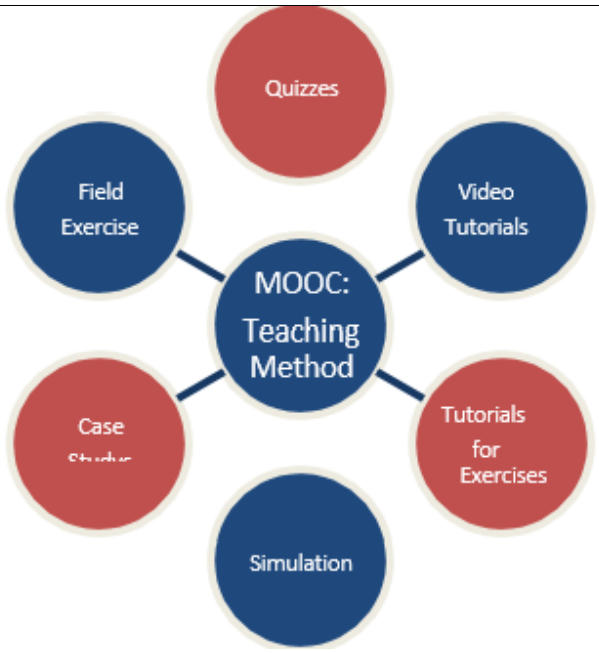
TEACHING METHODS	
OUTCOME	•After working on this topic, the teacher should be able: -Explain the use of an e-motor in a powertrain of a vehicle -Explain how a hybrid concept is working -Explain the failure modes which need to be controlled in the car -Explain the interfacs of the Emotor to other systems in the car to realise the electroic drive in a car •Knowing how: -Informatics, Physics, Chemistry, Biology, Mathematics, Ethics taught in schools can be mapped onto controlling electric powertrains.
EXERCISE	•Teachers map experiments and subjects in their school teaching to the provided knowledge of Electric Drive and System Concept •Teachers upload their mapping and make a proposal that can be exchanged with other teachers

TOPIC	**The Set Up of an E-Motor in Cars**
LENGTH OF THE TOPIC	8 hours and 8 hours Exercise
LEARNING CONTENTS	•3 phase synchronous motor •The concept of redundancy and safety •6 and up to 12 phase motors and why needed •Sensor concepts and measurements to control e-motors

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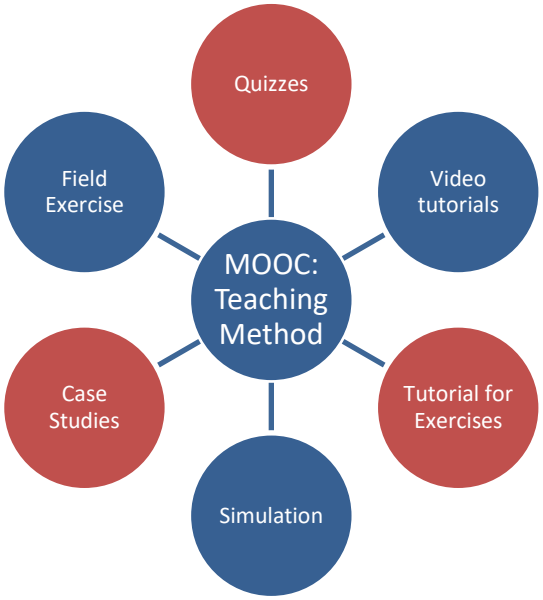
	•Faults that lead to hazardous driving situations and how to avoid the faults (software, sensors, electronic)
TEACHING METHODS	
OUTCOME	•After working on this topic, the teacher should be able: -Explain how a synchronous phase motor works -Explain why in Automotive 3 and now up to 12 phase motors are used and why? -Explain what diagnose functions are used in Software -Explain diffeerent sensor concepts to control the motor -Know the main Physical Principles which can be mapped to the school subjects of STEM teachers
EXERCISE	•Teachers map experiments and subjects in their school teaching to the provided knowledge of E-Motor in Cars •Teachers upload their mapping and make a proposal that can be exchanged with other teachers

TOPIC	**Interactive Session of School Teachers**
LENGTH OF THE TOPIC	4 hours
LEARNING CONTENTS	•All uploaded exercises (school teachers mapping their existing experiemnents and teaching content to the Automotive example) are shared online •Teachers present their ideas / proposals and agree •The moderator together with the teachers shares a pool of such proposed mappings to all teachers ➢ Transferring that new knowledge to the different STEM courses taught in school by a pool.

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TEACHING METHODS	Shared pool of school teachers‘ materials related to their mappin of existing experiments and teaching content to the Automotive example provided •Discussion is moderated
OUTCOME	•Growing shared pool of school teachers‘ materials related to their mapping of existing experiments and teaching content to the Automotive example provided

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MODULE 5: HOT TOPICS IN ENGINEERING

a) Energy Management
b) Autonomous Driving
c) Cyber Security

GENERAL DESCRIPTION OF THE MODULE

The goal of the module 5: "Hot Topics in Engineering" is to give some examples of current hot topics in the world of engineering including detailed description of innovative teaching methods and tools to impart this knowledge in a more understandable way to the teachers who interfere the knowledge.

LEARNING OBJECTIVES AND DESIRED COMPETENCES OF THE MODULE

The aim of the module is to introduce the teachers to some very current engineering topics and to give them a hint on how they can be introduced to the set teaching curriculum, combining the content with the required standard of STEM-subjects. The teachers should understand the basic functionalities behind the technologies and forge their own opinion regarding these topics. Therefore, the learning objectives are:

- Knowing, understanding and teaching the basics of energy management
- Knowing, understanding and teaching the basics of autonomous driving
- Knowing, understanding and teaching the basics of cyber security

LENGTH OF THE MODULE

1 module is equal to 1 MOOC week – so the length of the module will be 1 week.

TARGET GROUPS OF THE MODULE

Two main target groups could be identified for this module:
A: Teacher of STEM-subjects for secondary school pupils (General Secondary School)
B: Teacher of STEM-subjects for secondary school pupils (Natural Science Specialisation of Secondary School)
With the selected target groups and the didactical approach applied, the ELIC project makes sure that secondary school teacher will be equipped with the adequate tools to present engineering topics in classes in an appealing way to students while acting as multipliers and increasing the interest of engineering topics among the secondary target group of pupils.

PRE-REQUISITES FOR THE MODULE

- Well-founded knowledge in STEM subjects (European Qualification Framework (EQF)-Level 6-8:
  - Mathematics
  - Physics
  - Chemistry
  - Biology
  - Informatics
  - Technology
  - Computer Sciences
  - Biochemistry
  - Mechanics

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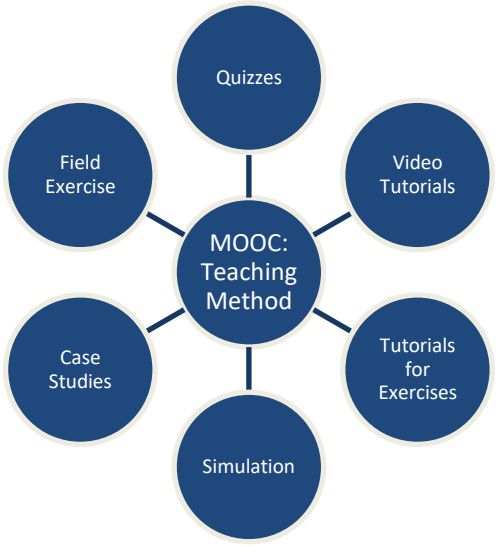
  - Electronics
  - Software
  - Renewable Energies
- Thinking interdisciplinary
- General understanding of all STEM subjects apart from the specialised STEM subject the teacher is an expert in
- Interest in broadening their knowledge

TEACHING AND LEARNING CONCEPT OF THE MODULE

Seven different types of online teaching and learning channels were defined. They will be available in the MOOC and are explained below:

- **Quizzes** – Checking the learning objectives through games or mind sports
- **Video tutorials** – Transferring the content of the module through videos
- **Tutorial for exercises** – Description for exercises in form of short videos
- **Simulations** – Learning the objectives of the content through simulating the technical principles
- **Case Studies** – "Cases" will be used to develop solutions for problems regarding the technical background of the topic
- **Field Exercises** – Practical examples and exercises from the industry



The figure illustrates the different types of learning and teaching channels of the module. The figure will appear in the tables of the detailed information on the different topics with the expected method used highlighted.

DETAILED INFORMATION ON THE TOPICS

TOPIC	**Energy Management**
LENGTH OF THE TOPIC	8 hours
LEARNING CONTENTS	• Creation of Energy • Transport of Energy

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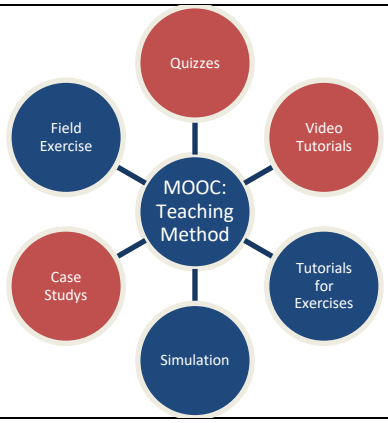
	• Storage of Energy • Energy Management and Cars ➢ Transferring that new knowledge to the different STEM courses thought in school.
TEACHING METHODS	
OUTCOME	• After working on this topic, the teacher should be able: - Explain how to create Energy - Explain how to transport Energy - Explain how to store Energy - Explain how the Energy Managements in cars works • Understanding the system engineering concept of energy management connected with car industry. • Knowing how: - Chemistry experiments and knowledge taught in schools can be mapped onto energy management. - Mathematics taught in schools can be mapped onto energy management. - Informatics taught in schools can be mapped onto energy management. - Biology and environmental issues taught in schools can be mapped onto energy management. - Ethics taught in schools can be mapped onto energy management.

TOPIC	**Autonomous Driving**
LENGTH OF THE TOPIC	8 hours
LEARNING CONTENTS	• What is a self-driving car? • Different types of driver assistance systems • Physical Principles: - Lidar

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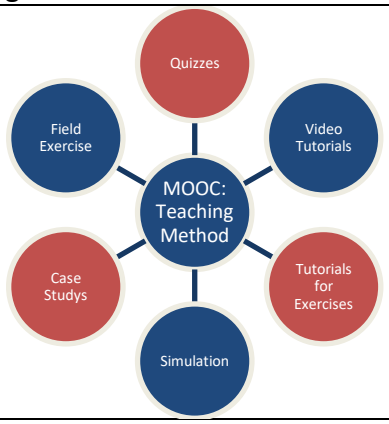
	- Radar - GPS ➢ Transferring that new knowledge to the different STEM courses thought in school.
TEACHING METHODS	
OUTCOME	• After working on this topic, the teacher should be able: - Explain what a self-driving car is - Name different types of Driver Assistance Systems - Know the Physical Principles • Understanding the system engineering concept of autonomous driving cars. • Knowing how: - Informatics taught in schools can be mapped onto autonomous driving cars. - Knowing how ethics taught in schools can be mapped onto autonomous driving cars.

TOPIC	**Cyber Security**
LENGTH OF THE TOPIC	5 hours
LEARNING CONTENTS	• Cyber Security in Times of Digitization and Industry 4.0 • Cyber Security and Standardization • Cyber Security in the Environment of Internet and Smart Home • What is Information Security? • What is the Difference between Cyber- and IT-Security? ➢ Transferring that new knowledge to the different STEM courses thought in school.

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TEACHING METHODS	
OUTCOME	• After working on this topic, the teacher should be able: - Explain why Cyber Security is important - Explain what Cyber Security has to do with Standardization - Name the Differences of Cyber- and Information Security • Understanding the system engineering concept of cybersecurity in cars. • Knowing how: - Informatics taught in schools can be mapped onto cybersecurity design. - Knowing how ethics taught in schools can be mapped onto cybersecurity design.

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MODULE 6: CONCLUSION

(1) Recap of the ELIC MOOC
(watch a short video, recap the hot topics of the MOOC, Test acquired skills)
(2) Feedback
(3) Final Quiz

GENERAL DESCRIPTION OF THE MODULE

The aim of this module is to highlight once again the topics that have been discussed in the ELIC MOOC. This will be done in order to summarize and assess the main skills that have been achieved on formats and methodologies that are useful to empower "Engineering Literacy". Feedback on the modules will also be collected in order to stimulate reflections and discussions within the group about the most suitable formats for each participant's teaching context.

LEARNING OBJECTIVES AND DESIRED COMPETENCES OF THE MODULE

- To summarize and memorize the main contents of all modules that have been discussed the modules
- To retrieve personal highlights and lessons learned by recapping contents
- To see the big picture and understand how to increase engineering literacy in secondary schools
- To know how to individualize the provided knowledge and contents in order to use it in class
- To be able to combine given examples with existing teaching plans
- To be ready and well prepared for increasing engineering literacy in secondary schools
- To have numerous ideas and input on how to get more technical contents in to STEM subjects

Reference to ELIC Skill Card: Performance Criteria (What a learner is able to perform)

U1 Development of Innovation

- Identification of Opportunities and Problems STEM Education Sectors
- Production and Evaluation of Ideas for innovative STEM Courses
- Research and Development Work, Prototyping and Presentation

U2 innovative teaching

- Innovative Teaching Methods
- Innovative Use of ICT in Learning
- Practice Oriented Teaching
- Multidisciplinary and Interdisciplinary Approach relevant for Engineering literacy

LENGTH OF THE MODULE

1 module is equal to 1 MOOC week – the lenth of this module will be **approximately 5 to 6 hours.** It will start on **10th of march and ends on the 16th of march 2019**.

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TARGET GROUPS OF THE MODULE

Two main target groups have been identified for this module, so for the entire MOOC:
A: Teacher of STEM-subjects for secondary school pupils (General Secondary School)
B: Teacher of STEM-subjects for secondary school pupils (Natural Science Specialisation of Secondary School)
With the selected target groups and the didactical approach applied, the ELIC project makes sure that secondary school teacher will be equipped with the adequate tools to present engineering topics in classes in an appealing way to students while acting as multipliers and increasing the interest of engineering topics among the secondary target group of pupils.

PRE-REQUISITES FOR THE MODULE

The pre-requisite for this module is having attended at least 3 modules including the introduction week of the ELIC MOOC. Further the pre-requisites from the first module (Introduction) are as well necessary to be fulfilled to complete this module.

TEACHING AND LEARNING CONCEPT OF THE MODULE

This module applies numerous teaching methods. The conclusion will be mainly assisted by questionnaires and quizzes. However, it will also ask for feedback in free-writing style in order to not restrict the freedom of expressing any opinion on the MOOC. Further a video that recaps all main contents and important topics will be produced – still it will not be possible to complete the final quiz only by watching this video. Otherwise the learning effect would be destroyed.

DETAILED INFORMATION ON THE TOPICS

TOPIC	**RECAP of the ELIC MOOC**
LENGTH OF THE TOPIC	2 hours
LEARNING CONTENTS	- highlights within the ELIC MOOC (most intensively discussed topics, best-practice examples) - short video with summarizing up - be aware of acquired skills during the ELIC MOOC
TEACHING METHODS	

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	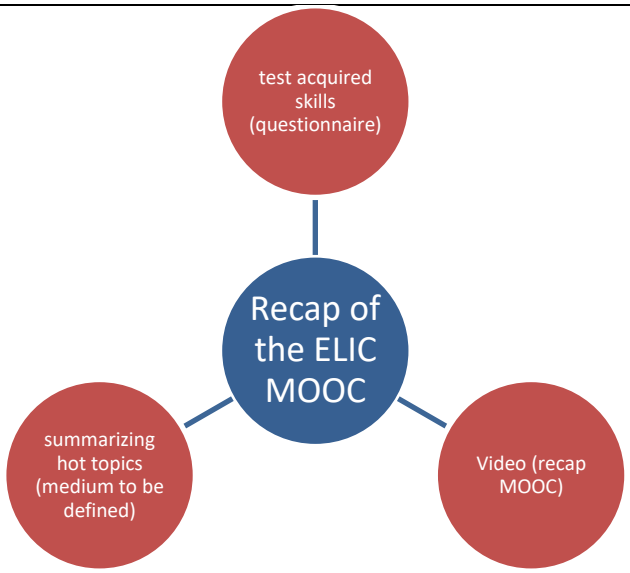
OUTCOME	After working on this topic, teachers should be able: - to know how STEM experiments and knowledge taught in school can be mapped onto each of the discussed modules - f.e. maths teachers know now, which examples he can integrate in order to increase engineering literacy in his lessons. (f.e. referring to battery systems, energy management, e-motors) - the participants have made a positive experience with the MOOC (innovative teaching platform) and might start using it more often - the participants know how to apply the ELIC toolbox when teaching - the participants have recognized that it can be simple to make STEM subjects more interesting through realistic examples, relevant in the future

TOPIC	**Feedback Circle**
LENGTH OF THE TOPIC	2 hours
LEARNING CONTENTS	• through providing feedback the participants will recap automatically all learned contents, difficulties and success stories automatically • participants will evaluate their experience of participating in a MOOC

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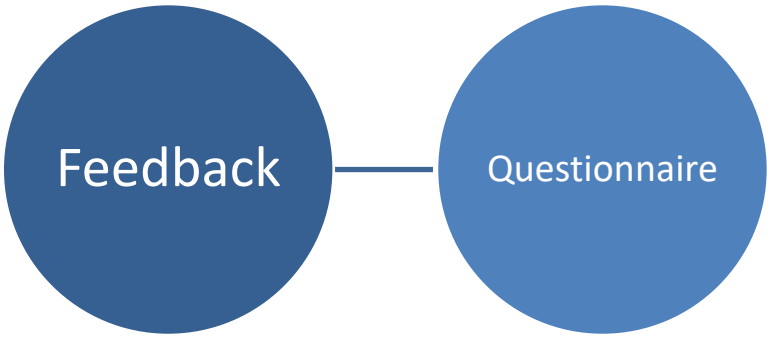
TEACHING METHODS	
OUTCOME	After working on this topic, all participating creators of the ELIC MOOC (content, structure, etc.) - will know what should be improved - have the chance to respond individually to the participants in case of negative feedback - will get valuable feedback for personal or professional development

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