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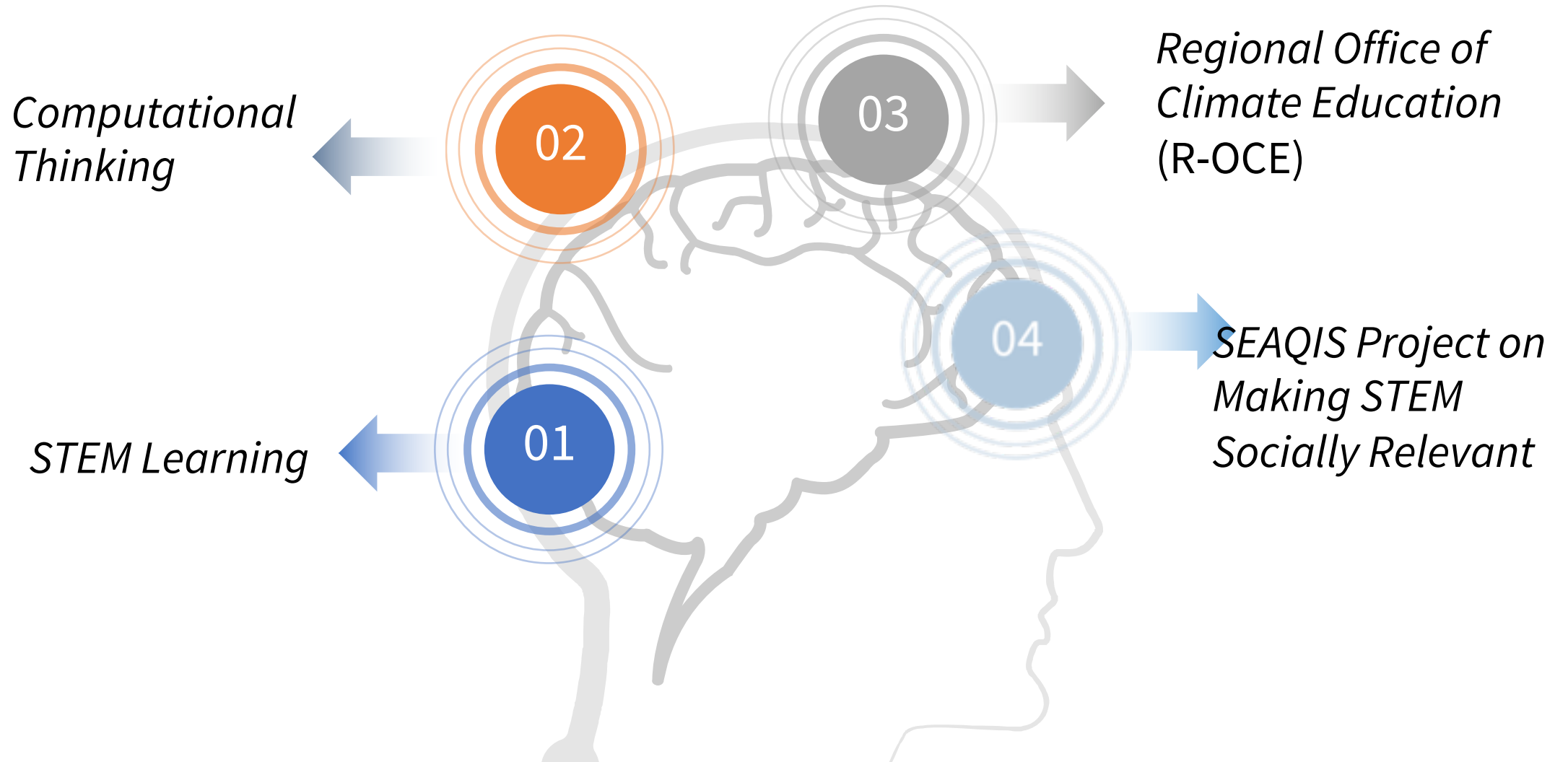
STEM LEARNING AND INDUSTRY 4.0 AS A MEDIA FOR CLIMATE CHANGE IMPACT MITIGATION

SEAMEO QITEP in Science

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Symposium VIII
13-14 February 2020
Tokyo Campus, University of Tsukuba
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FLAGSHIP SEAQIS

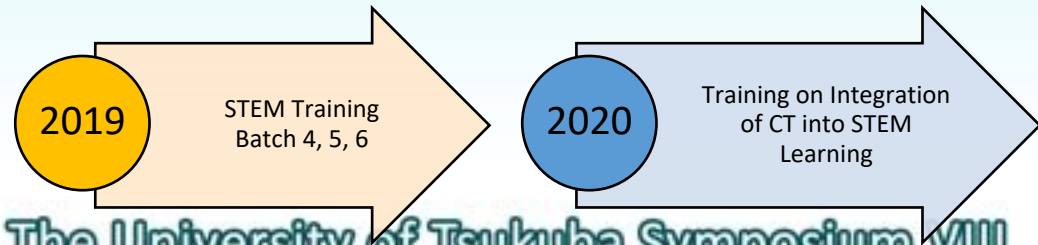
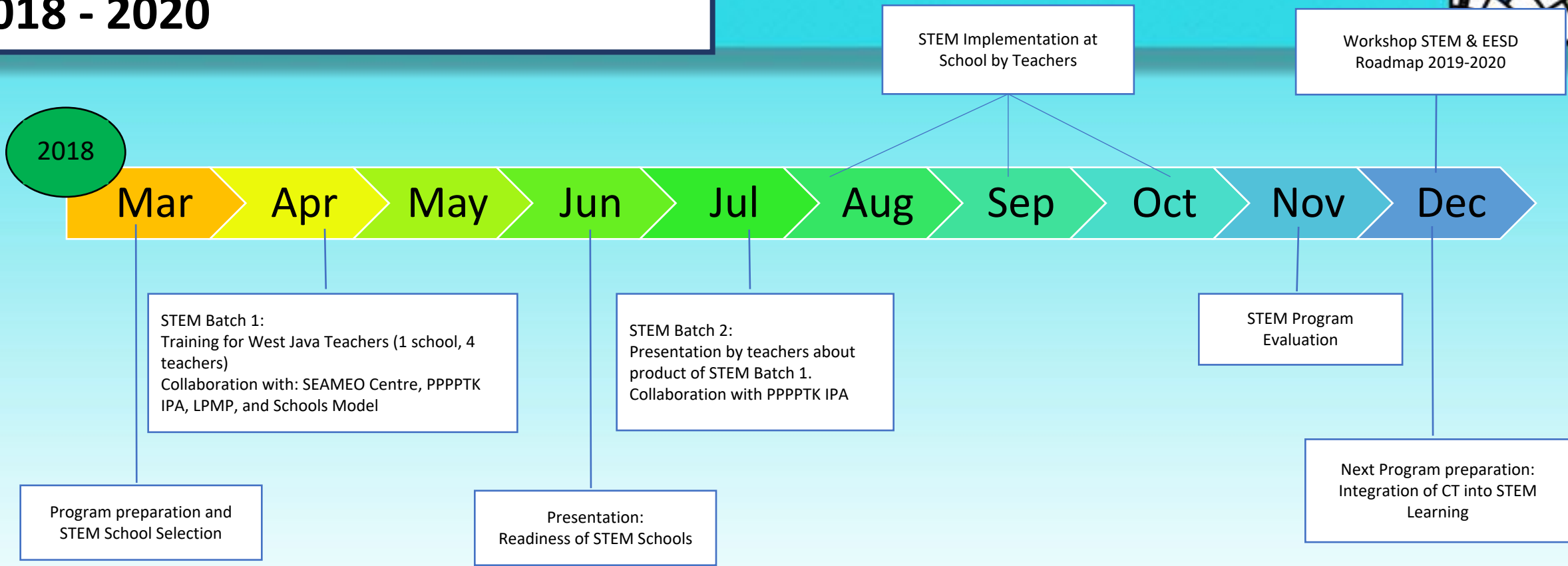




- Collaboration training with Academy of Technological Sciences Engineering (ATSE) Australia
- Conducted from 2015 – present
- This training focused on IBSE and STEM learning
- The main material presented on this training:
 - Energy
 - Water and sustainability
 - Global warming and oceans
 - Sustainable Housing
 - Water for 21st Century
 - Carbon Dioxide: Friend or Foe
 - Planning unit and lesson through IBSE

Training on STELR - STEM Education

STEM Program Development Timeline 2018 - 2020



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Regional Workshop and Training on Environmental Education for Sustainable Development in collaboration with Office for Climate Education (French)

Rationale

Education is an essential component and a catalyst to respond global environmental issues and climate change phenomenon.

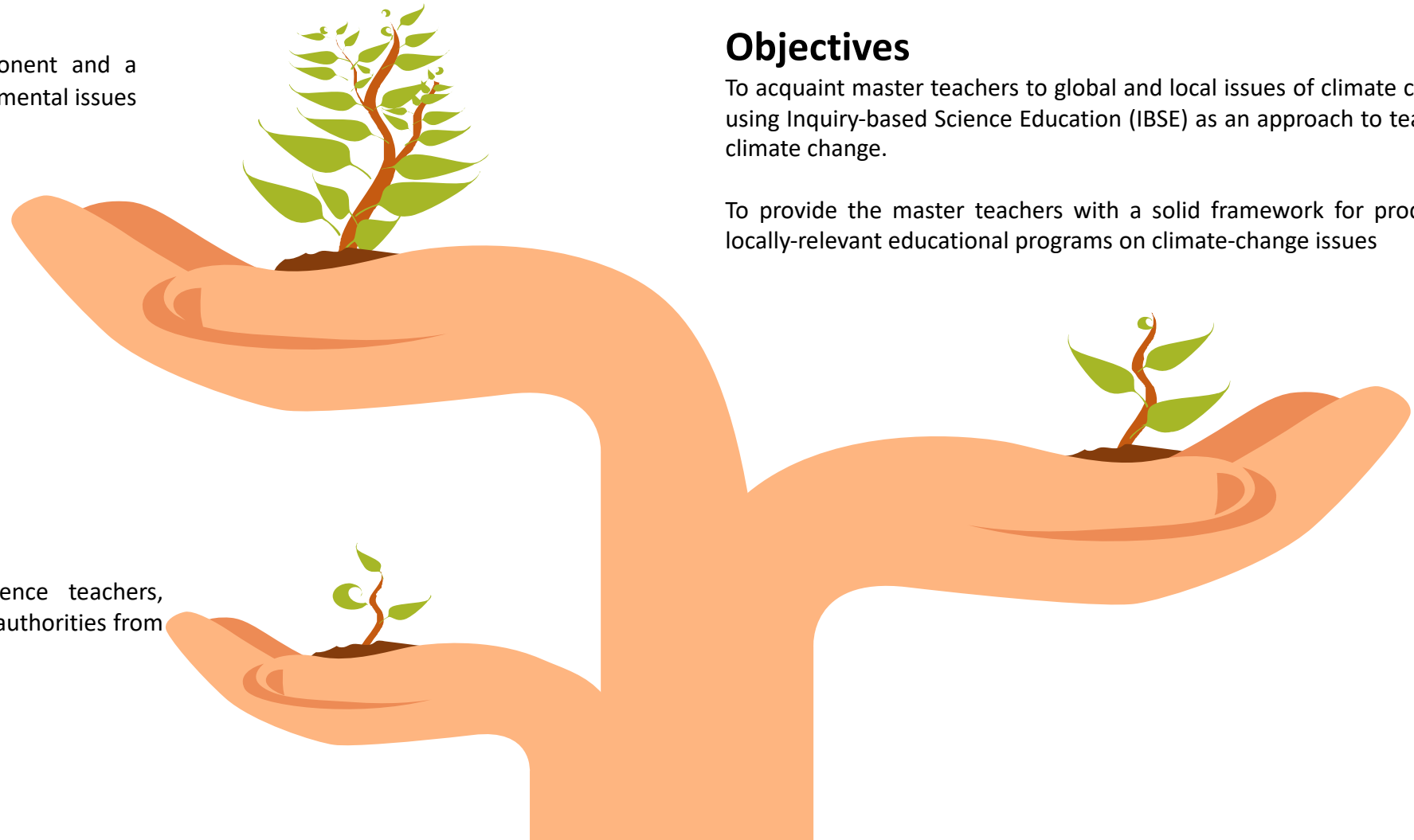
Objectives

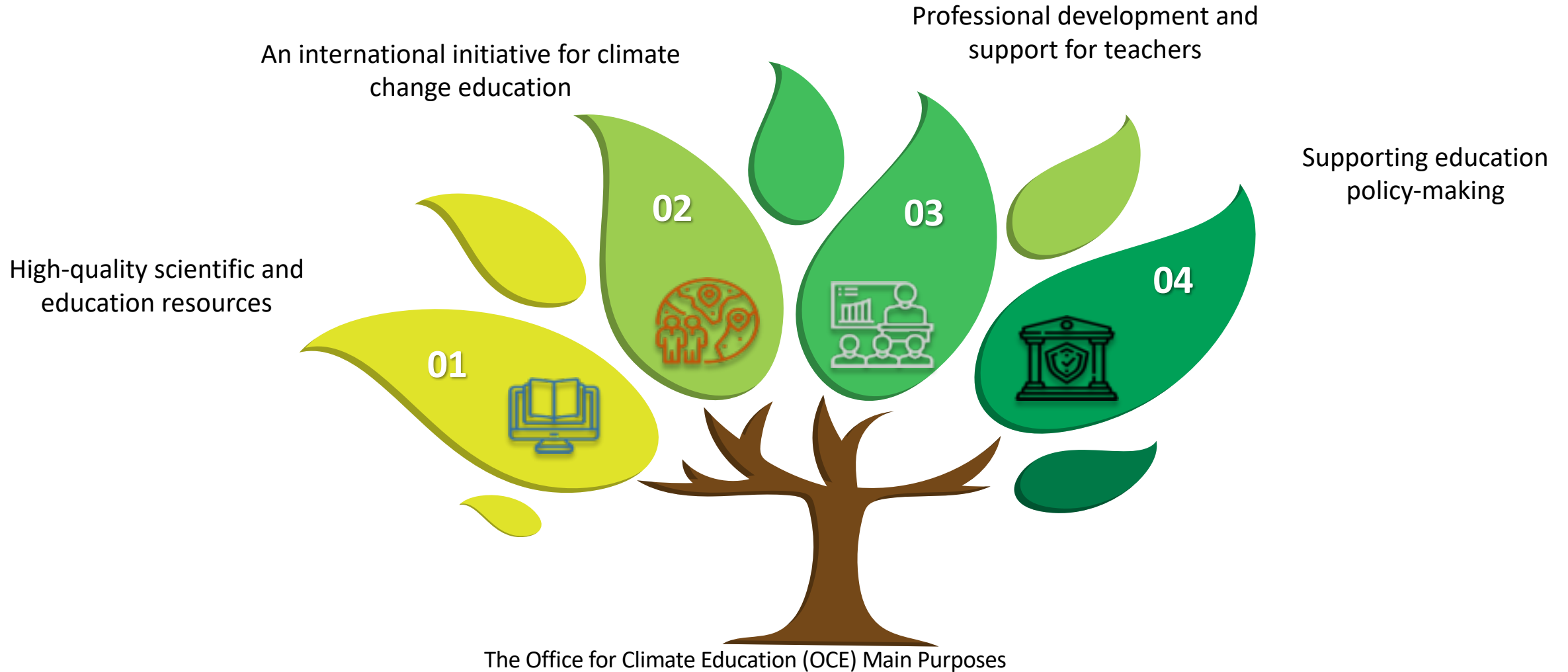
To acquaint master teachers to global and local issues of climate change using Inquiry-based Science Education (IBSE) as an approach to teaching climate change.

To provide the master teachers with a solid framework for producing locally-relevant educational programs on climate-change issues

Participants

Participants are about 35 science teachers, teacher trainers and educational authorities from SEAMEO member countries





Programme Structure



No.	Course Subject	Hours	
		Theory	Practice
1	Greenhouse effect and climate system	2	3
2	Conceptual scenario	2	4
3	Ocean	2	3
4	Poster session		3
5	Field Study on Biodiversity		3
6	Agriculture and Biodiversity	2	2
7	Production of pedagogical projects	4	6
8	Presentation of the pedagogical projects		4
9	Report and assessment of the workshop	4	



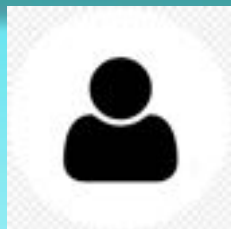
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STEM-based Local Potential Learning




Participants: 26 teachers from seven cities Kab. Bandung, Kota Bandung, Kab, Indramayu, Kab. Demak, Kota Solok, Kota Bontang dan Kab. Dompu



Courses strategy Model In service 1 – On Job Learning – In service 2 (IN 1 – ON – IN 2)

Expected results:

- 
1. Improvement on teachers' understanding on STEM learning based local potential
 2. Lesson plan of STEM learning based local potential
 3. Dissemination in teachers working group

Results



1. Improvement on teachers' understanding on STEM learning with N-gain 0,3 (medium).
2. 13 lesson plans of STEM learning based local potential.
 - a. Mangrove Ecosystem (2)
 - b. *Urban Agriculture* (5)
 - c. food production (5)
 - d. IoT (1)



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Implementation of STEM Learning based Local Potential Mangrove Ecosystem, Demak Districk, West java



Initial Observation



Planning solution



Producing



Testing



Communicate results



Product Launching by Regent of Demak



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STEM Learning Based Digital Technology

Development of E-Duta module based STEM



Carilah informasi terkait dengan sumber energi listrik terburukan dengan menggunakan bahan-bahan sekitar kemudian coba tuliskan pengetahuan Anda tentang hal tersebut pada tabel berikut ini.

Nama Bahan Alami	Sumber Listrik yang dihasilkan	Kegunaan
jeruk nipis	3 V	menghidupkan lampu
Limbah Cair tahu	5volt	sumber energi listrik

Jawablah pertanyaan-pertanyaan berikut.

- Bahan apa saja yang dapat digunakan sebagai sumber energi listrik?
Bahan-bahan yang memiliki atom atau molekul memiliki muatan yang berbeda.

RANCANGAN PROSEDUR DAN SET ALAT BATERAI BUAH DAN BATERAI LIMBAH

Tantangan

Berapa orangpun sudah tahu bahwa penting sebagai sumber energi listrik. Tapi ini merupakan pengetahuan umum dalam kehidupan sehari-hari yang banyak, seperti: HP, laptop, powerbank, mobil listrik, sepeda listrik, bahkan pesawat terbang. Nah, apakah Anda? Selain sebagai sumber kita ini merupakan energi listrik, limbah-limbah rumah tangga juga dapat memberikan air dan tanah. Akibatnya, lingkungan kita semakin tercemar, dan itu berbahaya bagi manusia. Dengan cara ini, kita bisa memanfaatkan limbah rumah tangga sebagai sumber energi listrik yang ramah lingkungan. Berikut adalah rancangan prosedur dan alat yang akan digunakan dalam kegiatan ini.

Alat dan Bahan

Model baterai sederhana yang dihasilkan menggunakan bahan-bahan rumah tangga atau menggunakan limbah yang terdapat di sekitar rumah dapat menghasilkan sumber energi listrik untuk digunakan pada alat-alat elektronik (misalnya, lampu LED, dan lain-lain).

Prosedur

1. Siapkan bahan-bahan yang akan digunakan.
2. Siapkan alat-alat yang akan digunakan.
3. Siapkan alat-alat yang akan digunakan.
4. Siapkan alat-alat yang akan digunakan.

Green Battery

- Project title: Development of E-Duta module based STEM
- Subject/School: Chemistry/Senior High School (SMA)
- Utilizing electronic module through Adobe PDF Pro to create E-Duta Module based STEM



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Learning
Implementation
Pictures



13-14



STEM Learning Implementation: Applying Simple Arduino to Create Blind stick



Technology: Arduino Uno
Subject/School: Physics/Senior High School

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Creating a prototype of Smart Home: IoT-based Electric Circuit



- Grade 10 Students of Vocational High School are expected to create a prototype of smart home where the electric circuit can be controlled by using internet remotely.



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INTRODUCTION

Industry 4.0 vs Climate Crisis



Global Risks Report		The 5 risks that will have the biggest impact in the next 10 years	
			rank
	Weapons of mass destruction		1
	Extreme weather events		2
	Natural disasters		3
	Failure of climate change mitigation & adaptation		4
	Water crises		5

(World Economic Forum, 2018)



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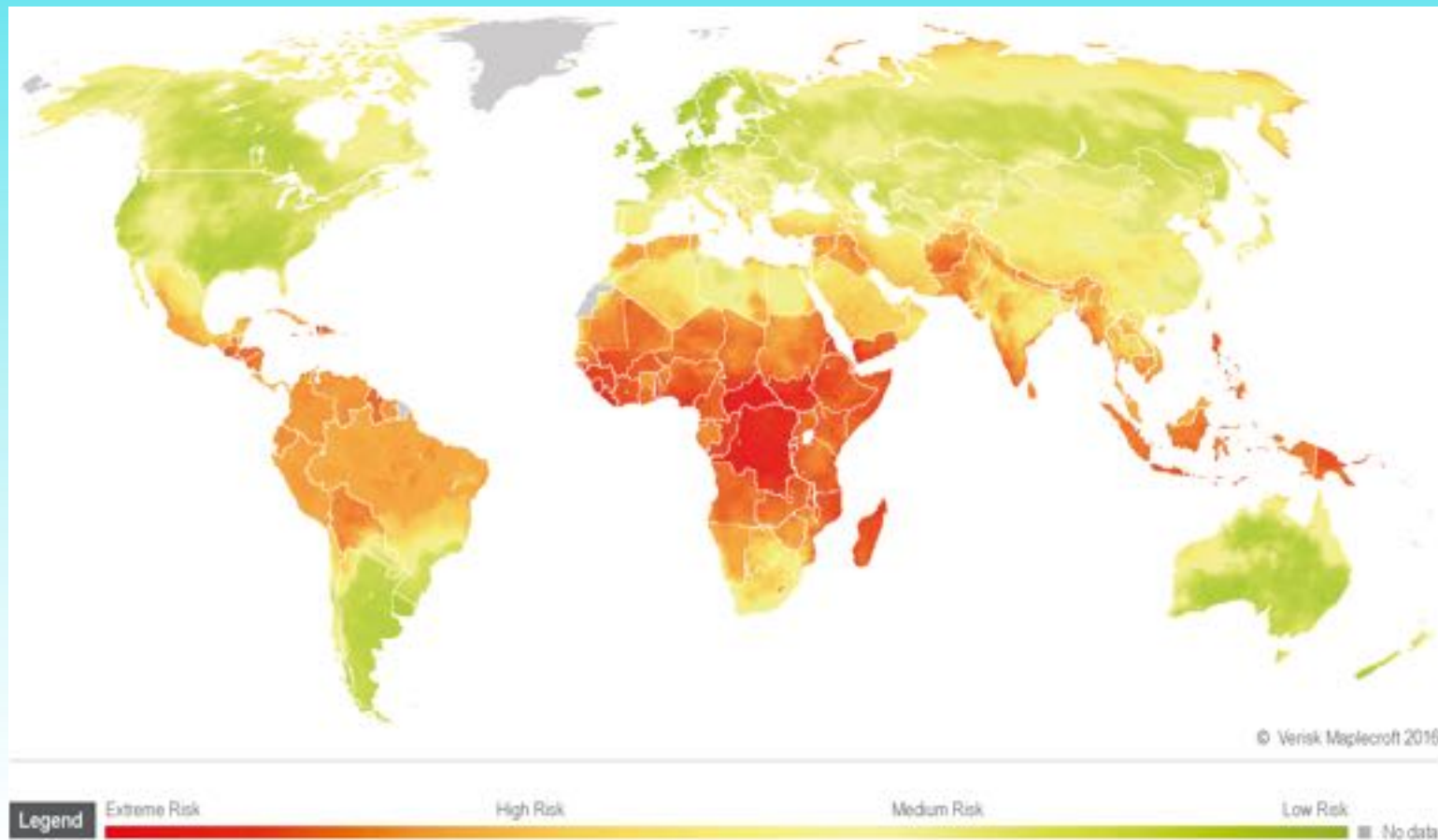
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MEXT

INTRODUCTION

Climate Change Vulnerability Index 2017



Picture: Verisk Maplecroft, 2017



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OBJECTIVE



- To find out whether STEM learning along with digital transformation can enhance the innovations created by student to mitigate climate change impact



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METHOD

Literature Review

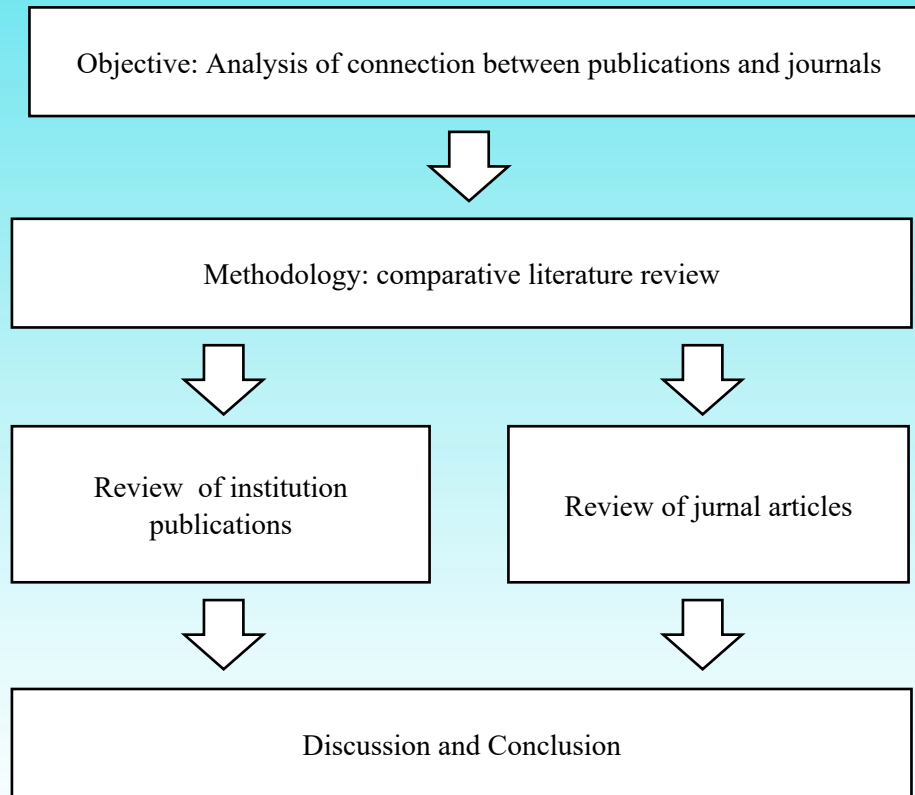


Figure 1. Overview of the research approach

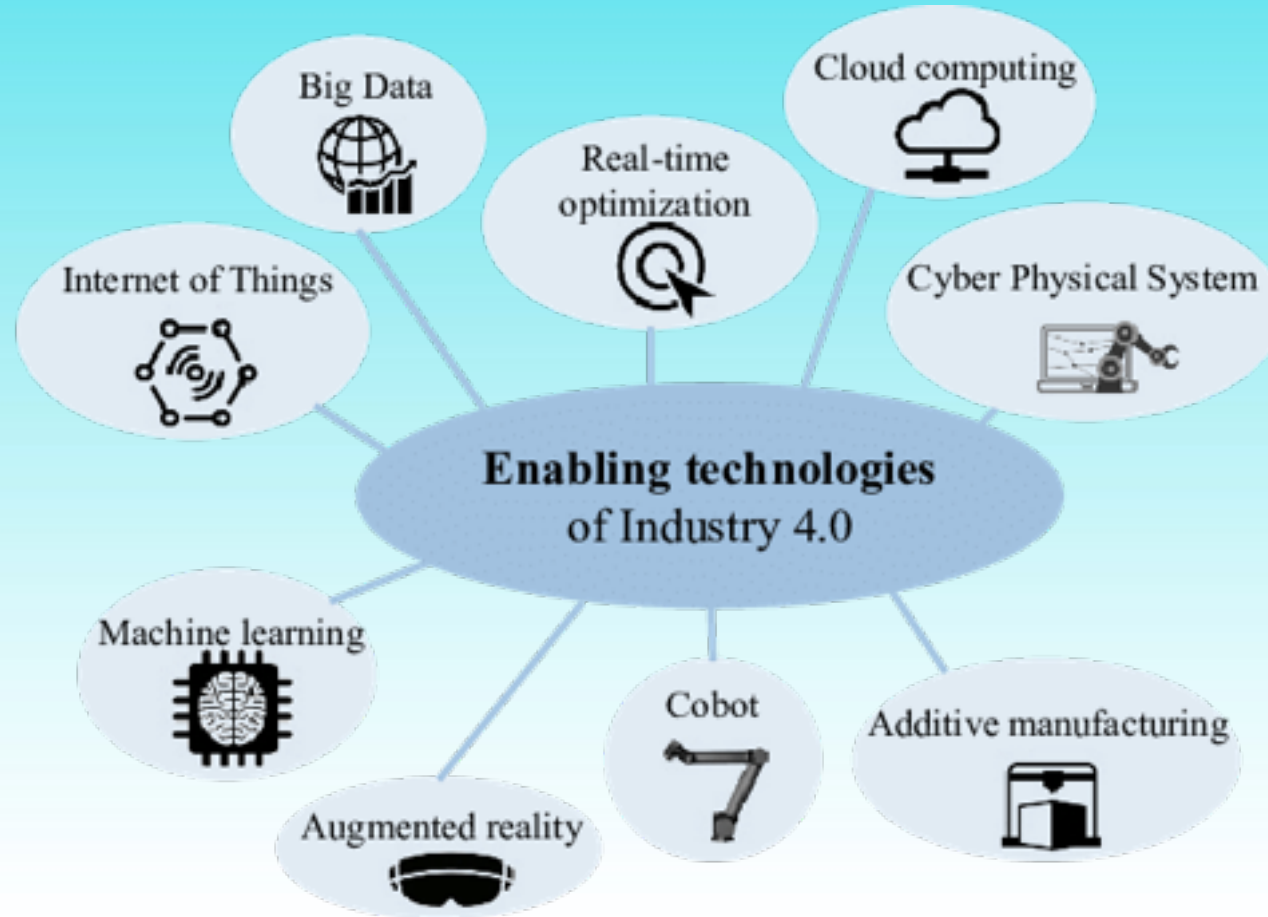
The review applies a two-tier approach:

- First, **analyze relevant international government institution publications** to identify trends and current issues in global community regarding potentials and threats on future development and their policies and strategies in facing that matters.
- In the second part of analysis, **conduct a review of peer-reviewed journal articles on STEM learning** to improve climate literacy and **4C skills** in connection with **digital transformation** in **industry 4.0** and **climate change mitigation**.
- Finally, **compare findings to identify meaningful conclusions** to further inform policymaking as well as research in the field of STEM learning and climate change mitigation.



DISCUSSION

Digital Transformation in Industry 4.0



Picture: IFAC, 2017



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DISCUSSION

Sustainable Development



- UN identified 17 goals of SUSTAINABLE DEVELOPMENT as SDGs
- These goals make up a blueprint for the future well-being of people, planet, prosperity, peace, and partnership
- **SDGs assign technology an important role** in achieving climate change mitigation and sustainable development
- **Education is a crucial part** of the SDGs



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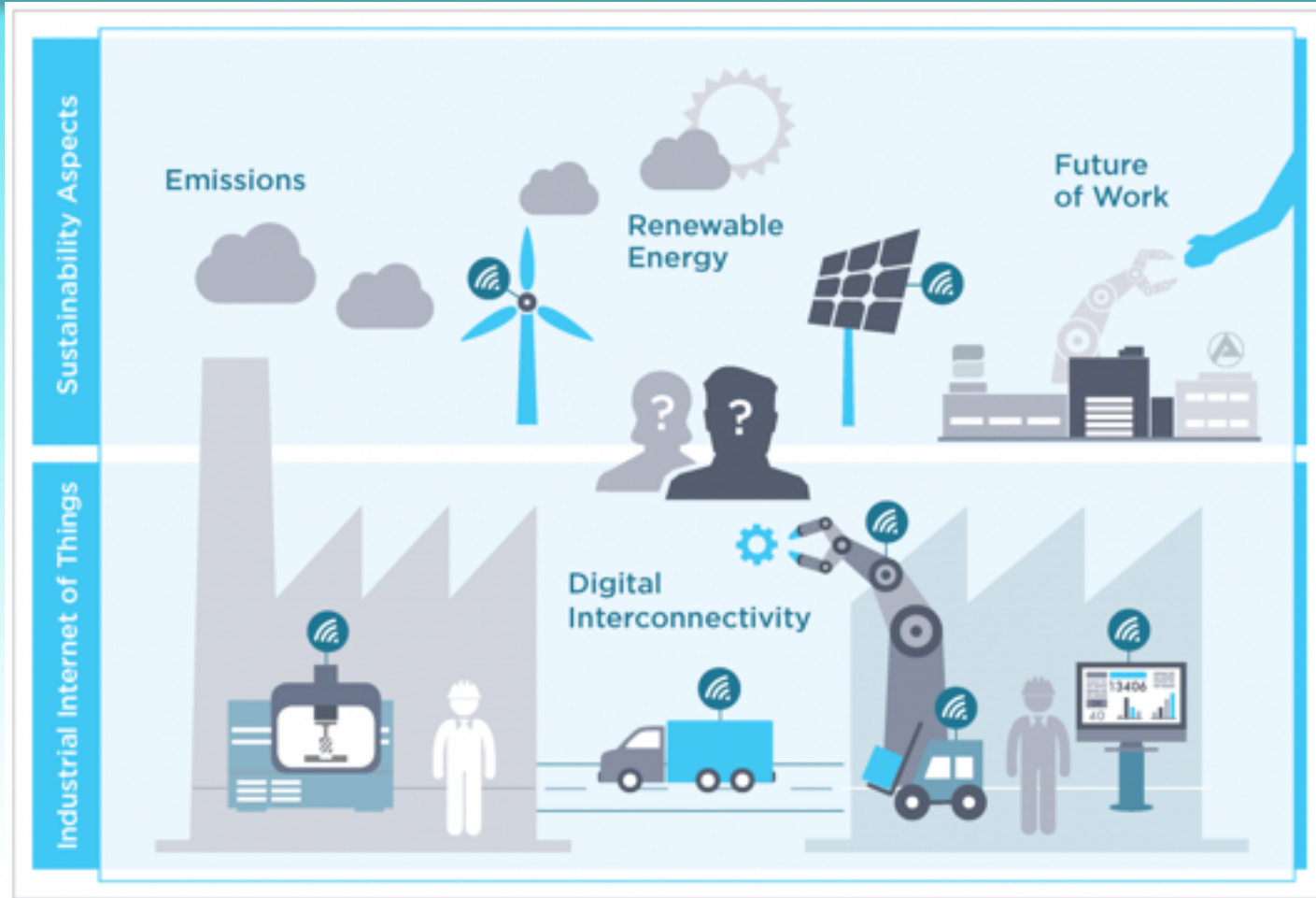


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DISCUSSION

Digital Transformation for Sustainable Development



Digital Transformation will contribute to the improvement of the human condition, especially in health, safety, mobility and education.

(Porter and Heppelmann, 2014)



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DISCUSSION

Digital Transformation for Climate Change Mitigation



Smart City

- AIR QUALITY
- NOISE MONITORING
- SUSTAINABLE DEVELOPMENT



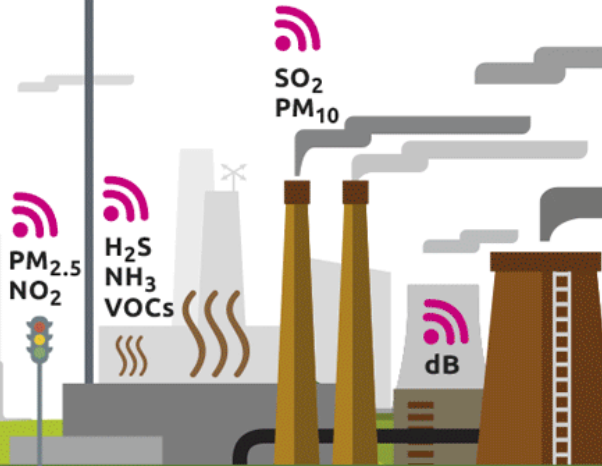
Smart Mobility

- MOBILE MONITORING
- INTELLIGENT TRAFFIC SYSTEMS



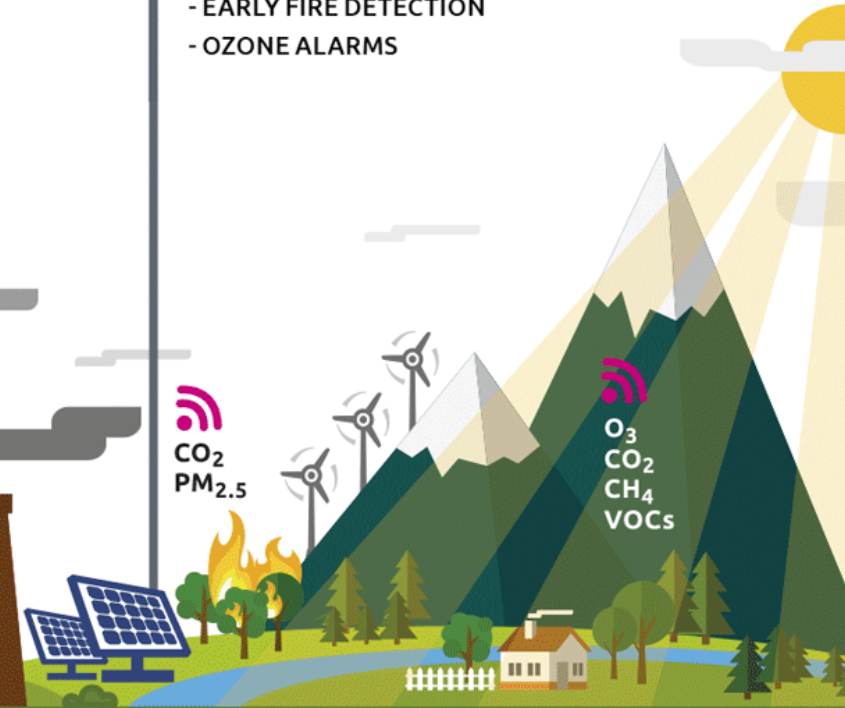
Industrial Emissions

- PERIMETER MONITORING
- INDUSTRIAL NOISE MONITORING
- ODOURS



Environment

- RESEARCH AND CONSULTANCY
- EARLY FIRE DETECTION
- OZONE ALARMS



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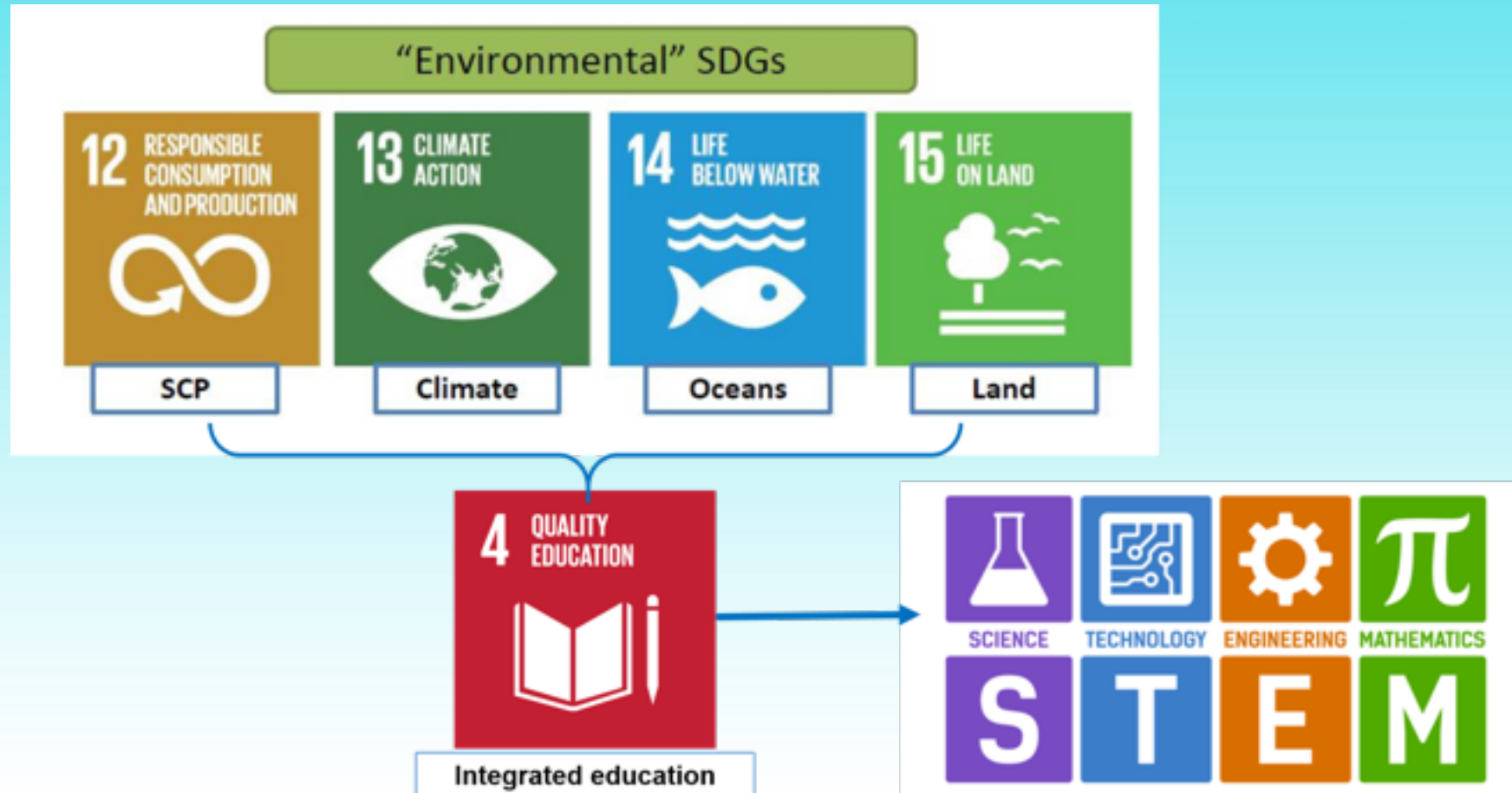


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STEM as form of Quality Education



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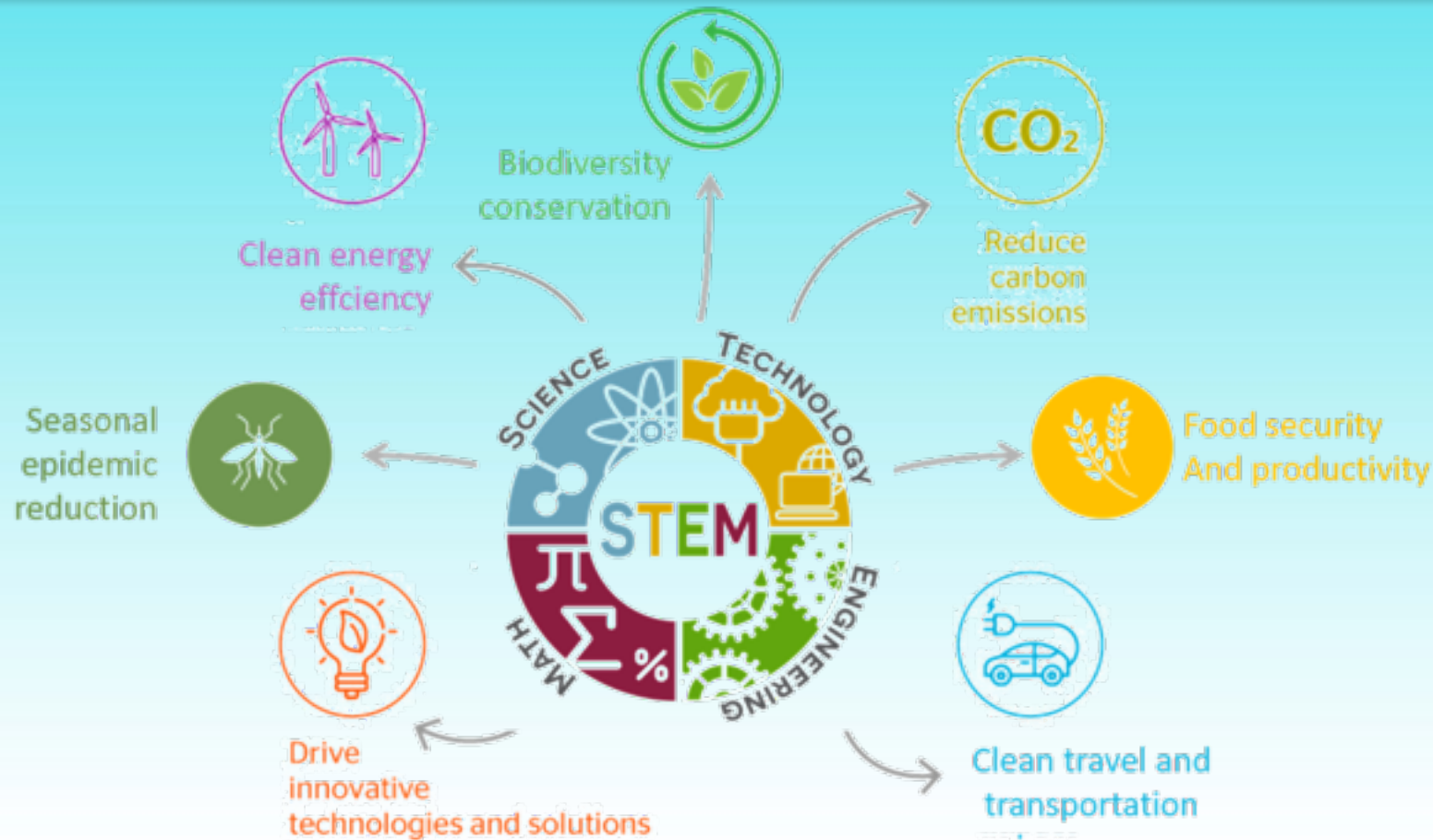


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DISCUSSION

STEM Project Related Climate Change Mitigation



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Additional: inquiry-based Climate change education



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CONCLUSION



- Education is vital for climate change adaptation. The role of education is critical in enabling informed decision-making based on projections of potential impacts
- Digital technology, plays an important role in STEM learning, students can learn about innovation, develop technological literacy, acquire digital skills, and learn about the effects of technology on the environment and sustainability
- Knowledge, skills and understanding of STEM phenomena are vital to help students understand climate change in a meaningful and knowledge-based way
- Climate Change impact mitigation are excellent projects for STEM learning in classroom because students are familiar with climate change through the utilization of their gadget as application of digital transformation in Industry 4.0



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