Integration of STEM Education, History and Culture

—— Introduction of the OBOR FoCEd Curriculum

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Thanktank: Handsbrain Educaiton
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Introduction

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The Key Laboratory of Child Development and Learning Science, MOE

Education Center for “Learning by Doing” Science Education Reform Pilot Program

MAIN TASK

- “Learning by Doing” Program
- Educational research on IBSE and STEM education
- National Teacher Training for trainers and teachers

The Global IAP Science Education Programme

* The IAP Science Education Programme was launched in 2003. Its main focus is the promotion of inquiry-based science education (IBSE) - or "learning by doing" - especially for primary-school-aged children. It is also focused on improving science literacy among the general population.

* Major efforts of IAP SEP have been focused on promoting inquiry-based science education (IBSE). IBSE is the “hands on” pedagogy that tries to wean schools, teachers and students away from book and rote learning.

The Global IAP Science Education Programme

* The working group of IAP SEP views IBSE as being not a single pedagogical method, but an approach having key features that can be implemented in various ways.

* The key factor of IBSE is engaging students in identifying relevant evidence, in critical and logical reasoning about it ant in reflection on its interpretation.

The Global IAP Science Education Programme

* IAP SEP has led IBSE initiatives and programs throughout the world for the past two decades. Many countries have adopted the IBSE pedagogy in primary and secondary schools.

* IAP has constructed an excellent global platform for science literacy,

* In China, from 2001, IBSE has been applied in science curriculum in primary school.

The Global IAP Science Education Programme

* IAP SEP has been an inclusive program. Global Council members have included representatives from organizations not related to academies. Amongst the most outstanding and successful are the China Association for Science and Technology (CAST), the Mexico-USA Science Foundation (FUMEC); ECO Science Foundation, Smithsonian Science Education Center USA and the National Science Museum Thailand.

The Global IAP Science Education Programme

- Although many developing countries do not have academies, they still needs a structured platform for science literacy.
- IAP SEP has identified “the Belt and the Road” Initiative of China as its partner for science literacy in the developing world.
- The combination of IAP SEP and B&R Initiative is very important for children in the developing world to get more effective science education.

IAP SEP Fusion of OBOR Civilizations Curriculum Design Project

* The IAP SEP “Fusion of OBOR Civilizations Curriculum Design” project is inspired by the Belt and Road Initiative of China, especially President Xi’s Five Principles for OBOR Initiative.

> We should build the Belt and Road into a road connecting different civilizations. In pursuing the Belt and Road Initiative, we should ensure that when it comes to different civilizations, exchange will replace estrangement, mutual learning will replace clashes, and coexistence will replace a sense of superiority. This will boost mutual understanding, mutual respect and mutual trust among different countries.”
>
> ----- President Xi Jinping

IAP SEP Fusion of OBOR Civilizations Curriculum Design Project

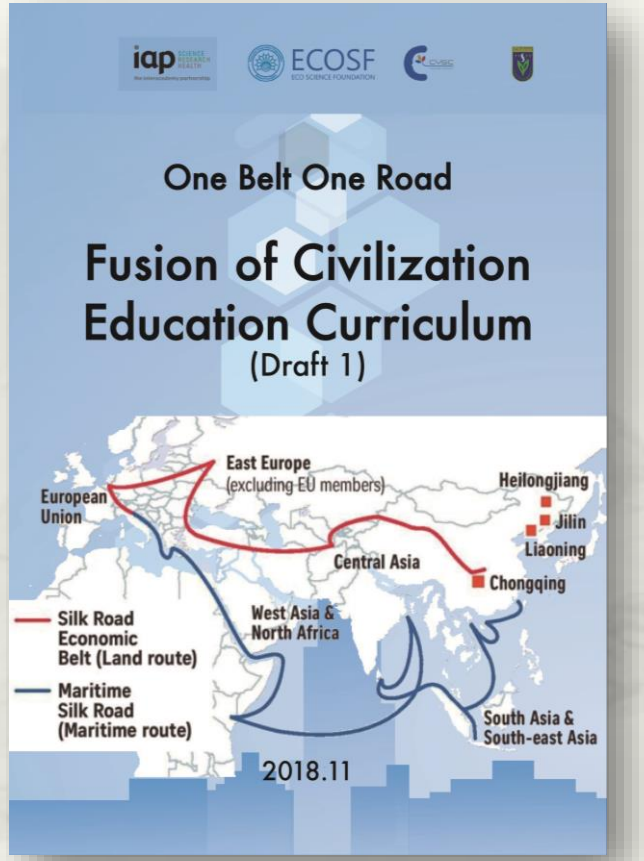
* Hence the urgent need for this Fusion of OBOR Civilizations Curriculum Design Project, since the ancient silk routes embody the spirit of peace and cooperation, openness and inclusiveness, mutual learning and mutual benefit.

* This Project was conceptualized in the IAP SEP Forum in Beijing July 2017.

IAP SEP Fusion of OBOR Civilizations Curriculum Design Project

* The project working party subsequently met in Kuala Lumpur December 2017; Islamabad, April 2018, Bangkok August 2018, Beijing September 2018 and next month in Nanjing again hosted by CAST.

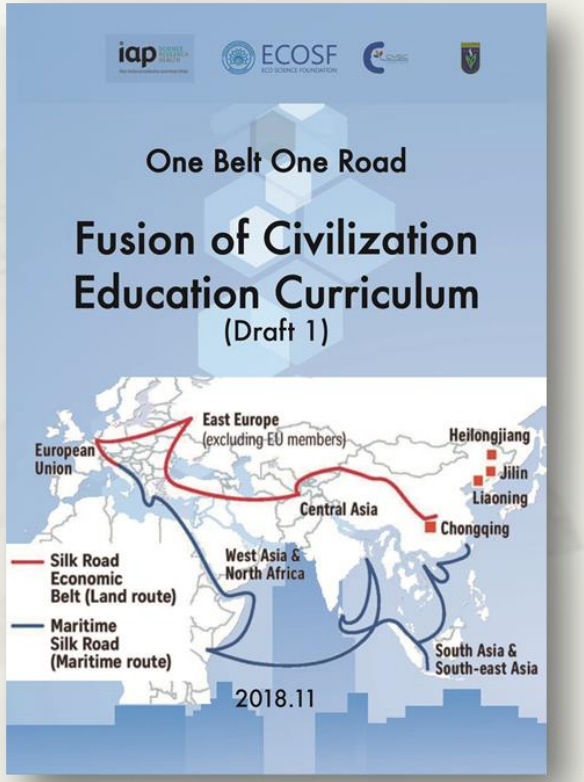
* The “Fusion of OBOR Civilizations Curriculum Design” project is given modern relevance by China’s “One Belt One Road” (OBOR) Initiative that aims to uplift the human conditions of the developing world by physical, cyber and cultural connectivity.



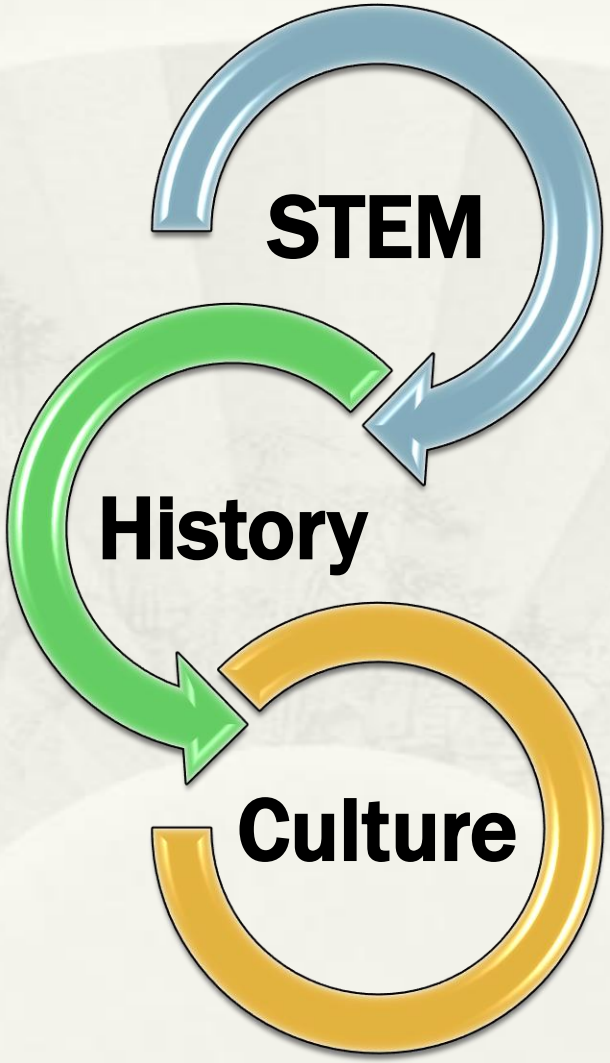
OBOR FoCEd Curriculum

- FoCEd curriculum is formulated in line with thinking that connectivity of discoveries in each civilization along the Belt and Road (B&R) Initiative and how such discoveries influence the cultures and civilizations for the betterment of human condition along the B&R countries and regions.

- Understanding the connectivity between neighbouring cultures and civilizations among children could be an approach to instil the awareness of the importance of living in peace and harmony. The content of the curriculum also include the role of the great travellers along the B&R that helped to spread the fusion of B&R civilizations.



What are the focuses of the project?



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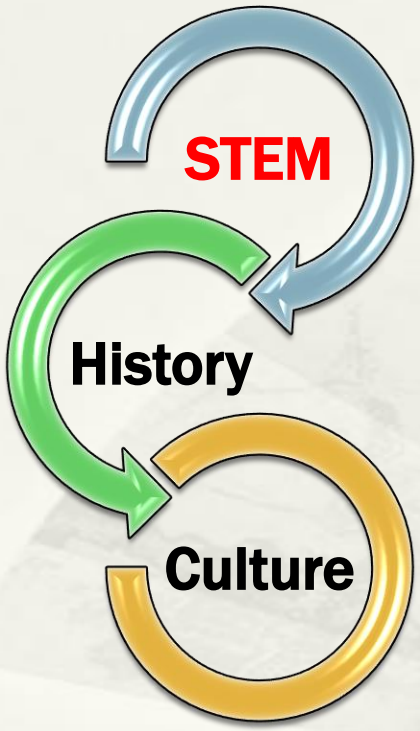
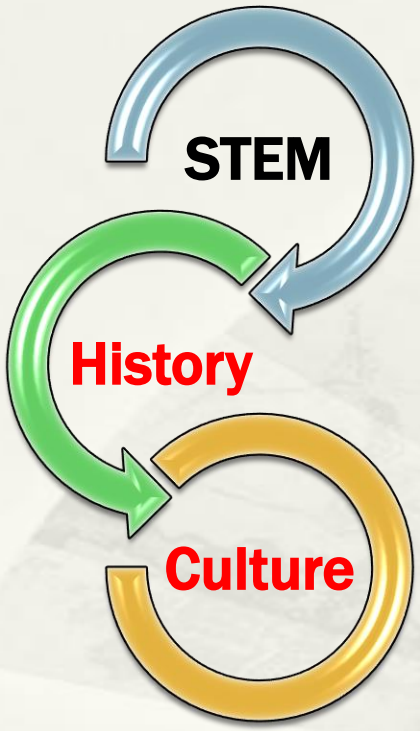


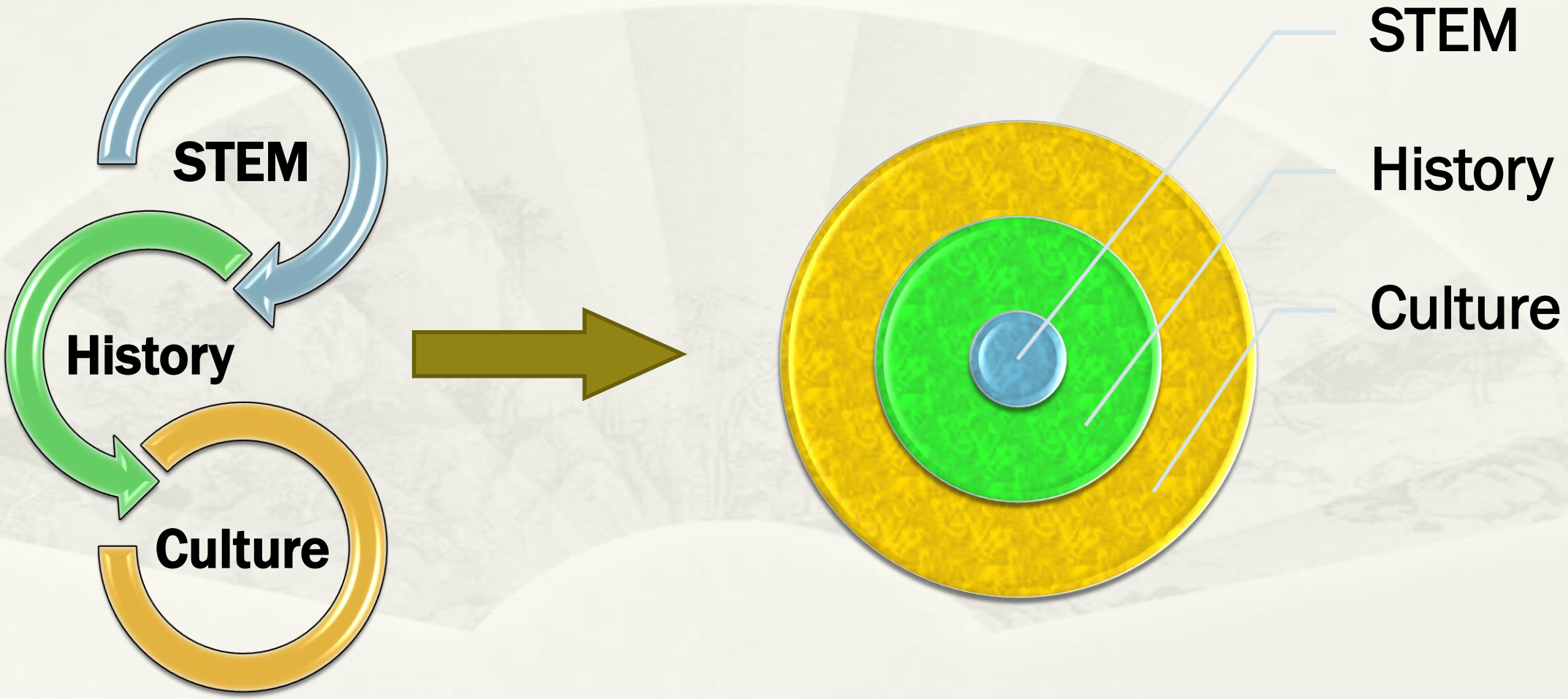
* STEM (Science, technology, engineering and mathematics) education have been recognized as the vehicle to enhance the inborn curiosity and creative instincts of children to face the rapid pace of development in industry 4.0 and the global digital economy.
* Thus stressing and promoting the importance stem education especially the evidence based or inquiry based science education (IBSE) methodology has been given more emphasized in educational program of many countries.

What are the focuses of the project?



* **History** is our best teacher. The glory of the ancient silk routes shows that geographical distance is not insurmountable. If we take the first courageous step towards each other, we can embark on a path leading to friendship, shared development, peace, harmony and a better future.
* **History** is a mirror. Only by drawing lessons from history can the world avoid repeating past calamity. The past cannot be changed, but the future can be shaped.

Fusion and integration



Definition of Terms (FoCEd)

FoC

FoC is connection of different civilizations that contribute to present day knowledge and bring global peace and harmony.

FoCEd Curriculum

FoCEd Curriculum is a set of plan and arrangement concerning the purpose, content and learning materials and how to use as a guide for learning activities to achieve specific aims of FoCEd.

Civilization

The level of developments at which people live together in peacefully in communities.

FoCEd

FoCEd is process of teaching, facilitating learning and acquisition of knowledge, skills, values, beliefs and habits that related to fusion of civilizations. .

What is the aim and objectives of FoCEd Curricullum?

Aim

FoCEd aims to promote tolerance and respect of other cultures and traditions through understanding of current scientific knowledge and discoveries driven from ancient wisdom to inculcate global peace and harmony.

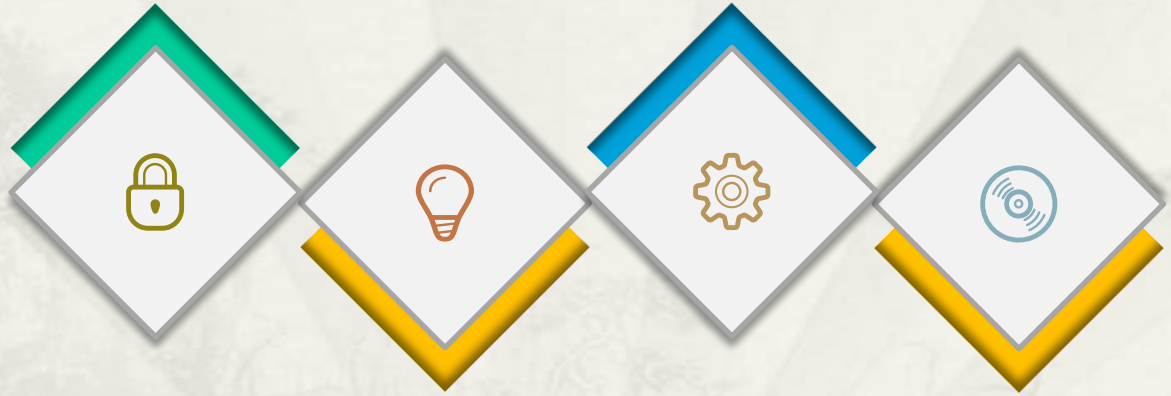
Objectives

1. To identify the knowledge and scientific process as the common way to solve problems.
2. To describe development and connection between the early inventions to present day innovations.
3. To appreciate the contribution of discoveries from various civilizations. iv. To demonstrate teamwork for promoting peace and harmony.

Declarative statements that describe main concepts that transcend grade levels. Big Ideas are essential to provide focus on specific science and technology content for students. The two big ideas, as evidenced the Belt and Road Initiative are Water and Land.

Describe the link among civilizations that contribute to present day knowledge to bring about the acceptance of differences for peace and harmony. The civilizations include ancient discoveries and inventors of civilizations along Belt and Road countries that contribute to the present innovations.

Framework of FoCEd Curriculum



Describe what students should acquire i.e. knowledge, skills, values, beliefs and habits that related to fusion of civilizations under each Big Idea as a result of teaching and learning specific to grade level.

Describe what students should be able to know, to do and to perceive the fusion of civilizations as a result of the instruction, specific to grade level.

Teaching and Learning

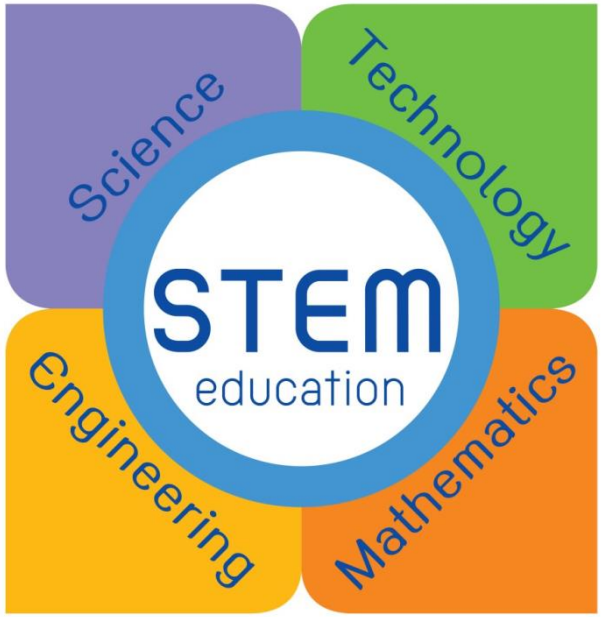
Teaching and Learning method

* Inquiry learning/discovery learning
* Problem based learning
* Project based learning
* Contextual learning

Cater the 21st century skills

* Critical thinking
* Communication
* Collaboration
* Creativity

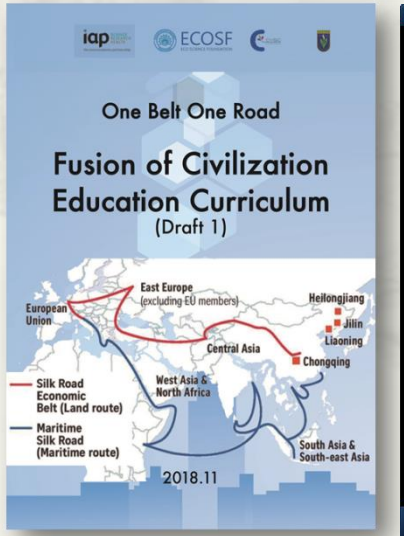
IBSE+STEM

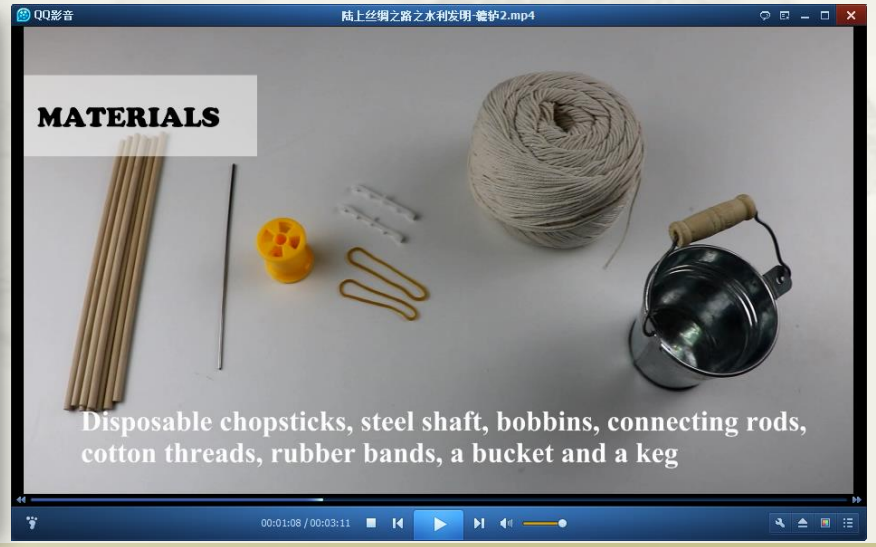


The outcomes of FoCEd curriculum

- A teacher guide to show the contents of curriculum
- A student's book for learning
- A material and tool kit for teaching and learning
- A network platform of teaching resources and outcomes sharing

- Teaching practice
- Teacher training





The contents of teacher guide

Part Ⅰ: Land Silk Road

- 1.Water resources
- 2.Astronomy
- 3.Architecture

Part Ⅱ: Maritime Silk Road

- 1. History of great voyages
- 2. Ships
- 3. Spices
- 4. Stars and navigation

The contents of teacher guide

Part I Land Silk Road	Unit 1. Water resource	Unit 2. Astronomy	Unit 3. Architecture
	Activity 1: The windlass Activity 2: The water wheel Activity 3: The water pump Activity 4: An oasis in the desert	Activity 1: Astrolabe Activity 2: Height of buildings Activity 3: telescope	Activity 1: pillars Activity 2: The roof Activity 3: Kuwait Water Tower Activity 4: The dome

Part II Maritime Silk Road	Unit 1. History of great voyages	Unit 2. Ship	Unit 3. Spice	Unit 4. Stars and navigation
	Activity 1: The navigation tool Activity 2: The windsock Activity 3: The important of monsoon	Activity 1: Zheng He's Junk Activity 2: The water line Activity 3: Water clock	Activity 1: Spices in my favorite food Activity 2: Food preservation experiment Activity 3: Testing my own recipe	Activity 1: Looking for Polaris Activity 2: Brightness of stars

Innovation for Water Resources in the Silk Road

Activity 1

The Windllass

Xi'an, originally known as Chang'an, is the starting point of the Silk Road, and is the capital of ancient China's Han Dynasty and Tang Dynasty. In this journey we start from Xi'an to the west. When passing a village in Lanzhou, we found some villagers around a well. They said that it is dry and rains little there, so they have to drill wells for drinking water. This is the best well in our village, because it is very deep and the water is sweet and delicious. In the past, it was strenuous to let down a bucket into the well to draw water. However, a single drop of rain did not occur this year so far, water level in the well drops so that water lifting methods we used before seem to be more difficult and dangerous. How can we get underground water fast er and easier?

History and Culture

QUESTION

In arid areas, water resources are very scarce, and underground water is mostly in deeper part. People obtain valuable water resources mainly by drilling deep. How to get water in the deep well? What kind of tools can get water more easier?

OBSERVATION

- Observe the pencil sharpener and tap. Talk about how to use them and the role they play.

- Can the sharpener work properly without using its handle ? Can you turn on the tap without using the handle?
- Think about the role the handle of the pencil sharpener and the fap play .
- What do they have in common?

WORDS TO KNOW

Axle: An Axle is a central shaft for a rotating wheel or gear, such as a screwdriver, a steering wheel, etc. An axle makes work easier.

TRY THIS

Engineering problems: Simulate wells with two tables 15 cm apart. Design a windlass that lifts a bucket filled with water from the ground to the tabletop. The bucket is 10 cm in diameter, the height is about 80 cm above the ground.

MATERIALS

disposable chopsticks	bobbins
wooden sticks	cotton threads
steel shaft	rubber bands
connecting rods	a bucket and a keg

QUESTIONS FOR THE ENGINEER

- What parts make up a windlass?
- What does each part like?
- What is it made of?
- What kind of structure can support the windlass?
- Why do you install a thicker cylinder on the shaft? What materials can be used?

PROCEDURE

1. Design

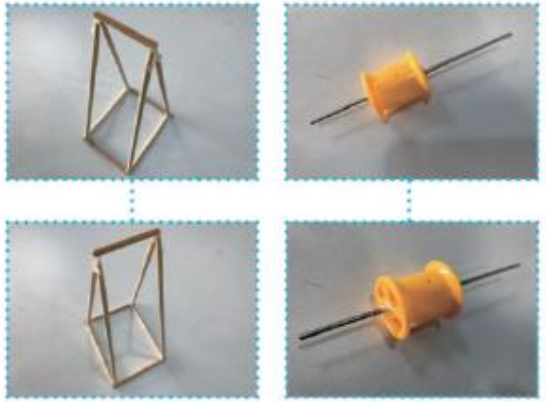
Please draw your design and calculate the dimensions.

2. Make

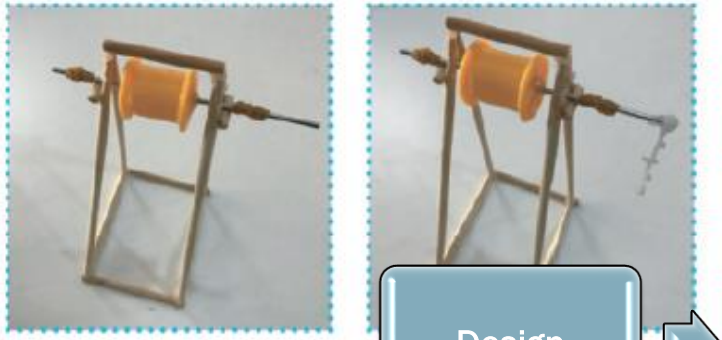
Select materials based on your design. Any changes to the design when you make need to be annotated on your design. When you have any difficulty, ask for help from others.

Reference methods

1. Use disposable chopsticks to build the support.
2. Select appropriate radius of bobbin around the steel shaft and firmly fix it with the glue gun.

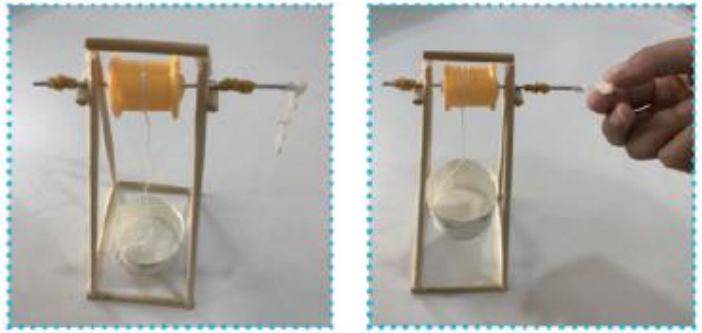


3. Fix the steel shaft with bobbin on the support, and cover the two ends with rubber bands to keep them from shaking around.
4. Choose a connecting rod with appropriate length around the end of steel shaft as a handle, adhere with the hot glue gun.



5. Take a suitable length of cotton thread. [illegible] the other on the keg.

6. Turn the handle and intertwine the cotton thread with bobbin to lift the keg.



3. Test

- Place two 80cm-high tables 15cm apart.
- Pour water in the bucket and place it in the interval between two tables to simulate the well.
- Place the well-made model on the table and fix it.
- Put the keg into bucket and fill it with water. Measure the force used to lift the bucket of water at the handle.
- Turn the handle so that the keg rises.Count how many times the handle need to rotate when the keg from the bottom of the well (bucket) to the wellhead (table top) .
- Measure the keg directly with a forcemeter .

4. Improvement

- If you lift up the keg very strenuous, how can you improve it.
- If windlass gets water with too many turns, which causes the lifting speed too slow, how can you improve it.
- If your windlass is broken while it works, how can you improve it.

Design → Make → Test → Improve → communicate

FUN FACTS

As early as in the 1000 BC, the Chinese working people invented windlass. In the Spring and Autumn Period, there was a record of using windlass to lift copper from the well. Later it was mainly used to raising water from deep wells. windlass consists of the stand, bobbin, handle, rope, bucket, etc. The rope is wound onto one drum while it unwinds from the other, with a movable pulley hanging in the bight between the drums. Turn the handle so that the bucket can get water up and down . The manufacture and application of windlass is closely connected with the development of agriculture in ancient times, and it is widely used in agricultural irrigation. Nowadays, windlass is gradually replaced by electric water pumps.

FOLLOW-UP

- What kind of tools can raise water from deep wells in your country? What theory is it based on?
- Could you find the shaft in your life?

Investigate more fun issues and stories related with history and culture, compare and understand

Find more questions to inquiry and investigate

2018 National Conference of China Association of Children's Science Instructors (CACSI)
2018 International Forum on Science Education
—— Science Education for Future
Chongqing. China　2018.08.16-08.18

Workshop activities from Handsbrain Education for OBOR teachers

Workshop 1
Ocean Navigation in the Maritime Silk Road

Ship Model: *Nanhai No.1*

Zheng He

Engineering Task:

The shipyard was asked to manufacture the sailing ship with the deadweight of 400 tons at reasonable cost. The maximum length of the ship is 138 meters, and the width is 56 meters.

Questions about building a sailing ship prototype

SCIENCE
科学

- What is the basic structure of a Sailing Ship?
- What forces affect the Sailing Ship during the voyage?
- What affects the deadweight of a sailing ship?

……

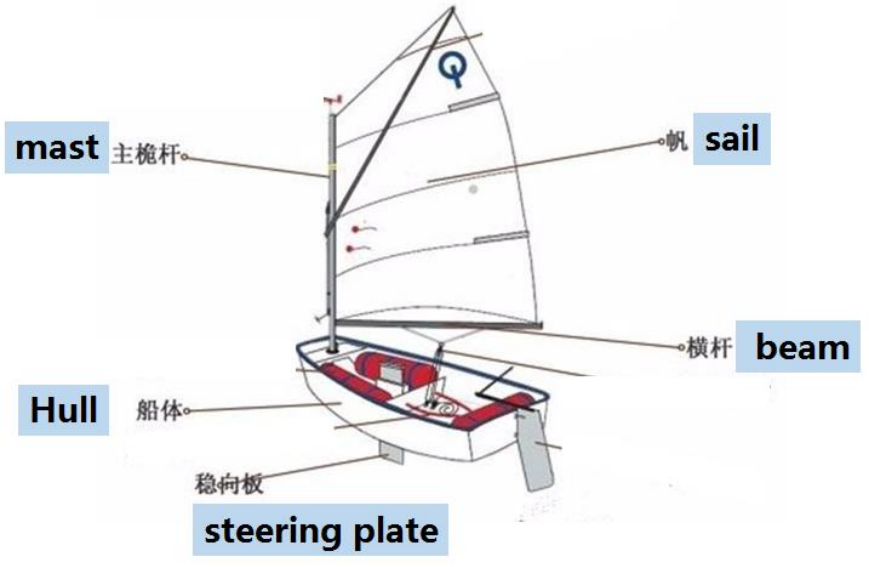
ENGINEERING
工程

- How big will it be?
- What materials can we use?
- What is the cost of it?
- How will we test it?
- ……

Workshop activities from Handsbrain Education for OBOR teachers

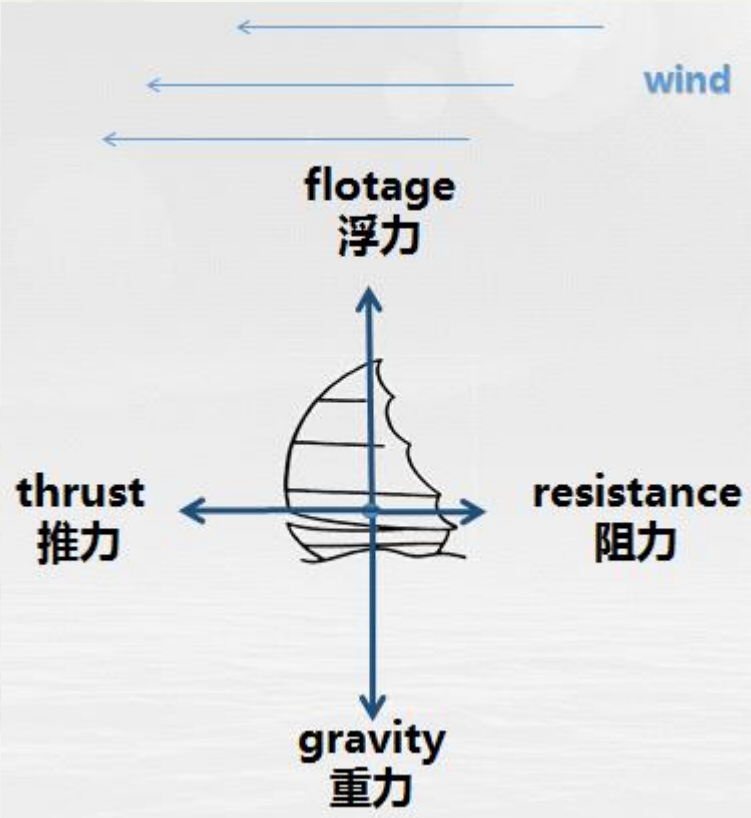
Workshop 1
Ocean Navigation in the Maritime Silk Road

Structure of Sailing Ship



Sailing-boat Models

Forces on the Sailing Ship



Workshop activities from Handsbrain Education for OBOR teachers

Workshop 1
Ocean Navigation in the Maritime Silk Road

Challenge 1: The sailing-boat shall float smoothly on the water for more than 3 minutes.

Challenge 2: The sailing-boat shall carry five nuts and float smoothly on the water for more than 1 minute.

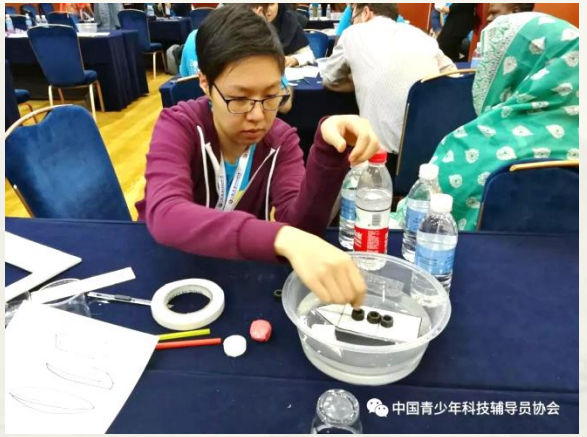
Challenge 3: The sailing-boat shall move steadily forward by fanning gently.

Challenge 4: Continue to add more nuts on the boat , and find out the maximum number of the nuts the boat can hold.

Workshop activities from Handsbrain Education for OBOR teachers

Trainer from Handsbrain Education

Brainstorm before design model



Test model in small “sea”

Cooperation when making model

Test model in big “sea”

Learning group

Sailing ship models made by teachers

Family photo of the teacher training session

Curriculum Team

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- Dato' Dr. Sharifah Maimunah Syed Zin, special assistant to IAP SEP Global Council Chair.

Thank you for attention

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Thank IAP SEP, ECOSF, CAST, CYSC, CACSI