

KNUE UNESCO-UNITWIN

**Developing Teacher Training Program
on STEAM Education for UNITWIN
Partners**

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Purpose

- The purpose of this presentation is to promote mutual cooperation among KNUE UNESCO-UNITWIN partners by serving to establish a teacher education system in partner countries and provide support for the sustainable development of education.
- The main goals of this talk are as follows:
 - ✓ Look into educational policies of Korea for implementing STEAM education in the national curriculum and school setting
 - ✓ Examine the STEAM teacher education system of Korea; enhance teacher's competencies to integrate STEAM education into actual teaching-learning environments
 - ✓ Share the content of STEAM teacher training program developed for UNITWIN partners

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Global Status of Science-based Convergence Education

Many countries are actively promoting science-based convergence education and cross-disciplinary approach to teaching including STEM and MINT.



USA

Legislation related to STEM

- Endorsed 'STEM Education Act of 2015' to support and expand STEM school education



Australia

STEM Education Strategic Plan 2016-2026

- Declared in 2015 'National STEM school Education Strategy 2016-2026' to ensure students are equipped with STEM skills and knowledge



Germany

MINT(Mathematik, Informatik, Naturwissenschaft, Technik)

- Introduced in 2011 MINT education to strengthen education in sciences/technology and interdisciplinary fields



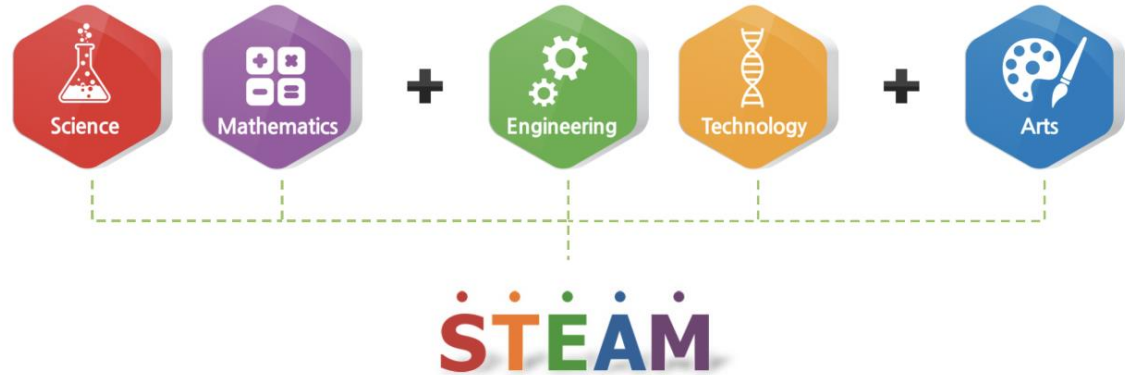
Finland

LUMA(Finnish word for Natural sciences and math)

- Set up the national strategy for LUMA 2014-2025 to promote students' competence in LUMA subjects

STEAM Education

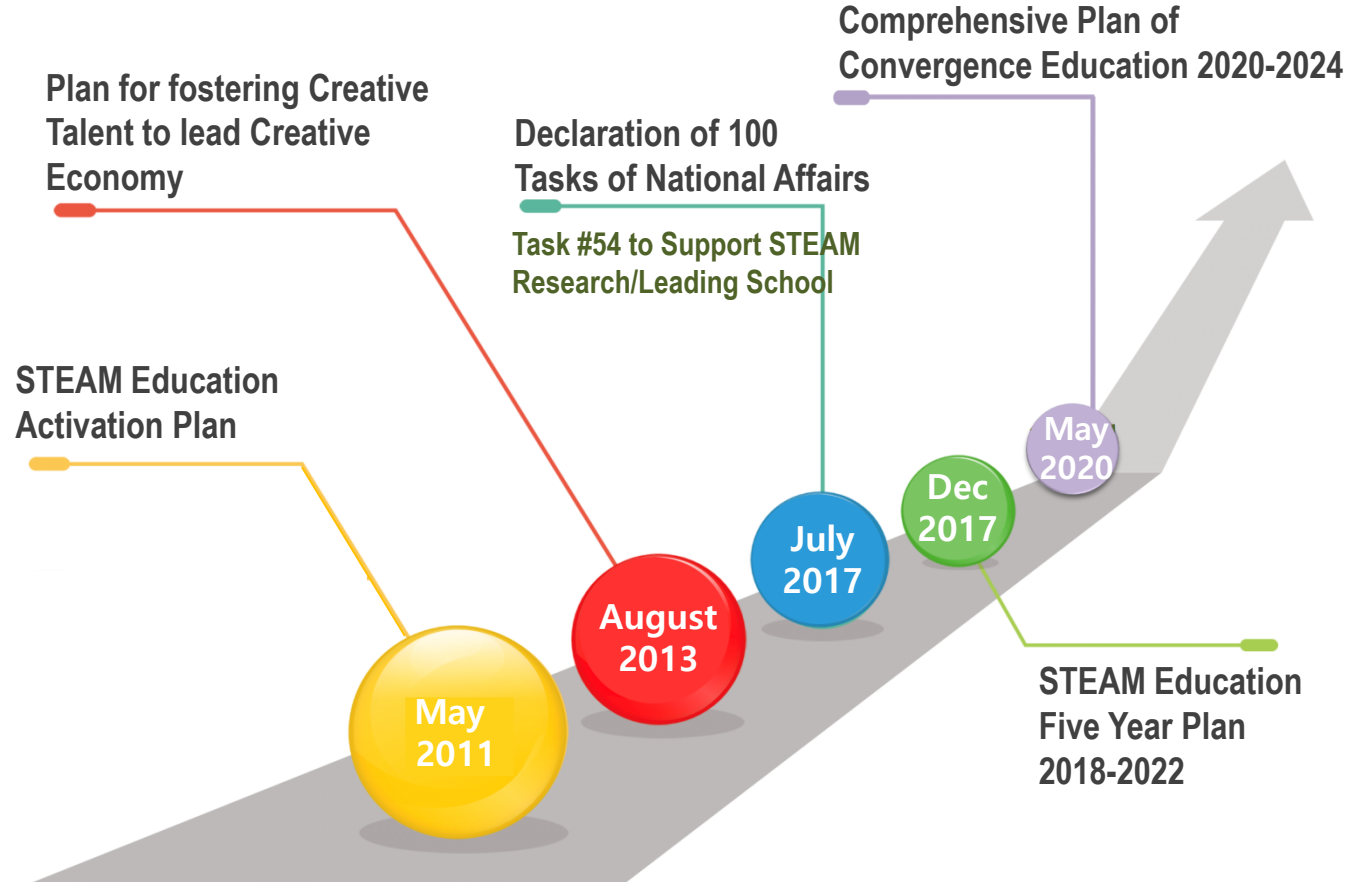
A growing number of schools in many countries are now incorporating teaching method and content that are more in line with STEAM. By



- ✓ STEAM stands for Science, Technology, Engineering, Arts, and Math, combining STEM and liberal/fine arts & humanities. By adding Arts, we can enhance STEM learning by introducing a greater sense of creativity.
- ✓ STEAM in Korea: "convergence/integrated education that aims to increase students' interest in and understanding of science and technology by enhancing their convergent thinking and problem-solving abilities"
(Korean Ministry of Education and Science, 2011)

STEAM Education in Korea

STEAM Education in Korea



* Source: steam.kofac.re.kr KOFAC (Korea Foundation for the Advancement of Science and Creativity)

Background of Introducing STEAM Education in Korea

- Korean students' High Scores but no confidence in Science & Math
- ✓ The International Association for the Evaluation of Educational Achievement (IEA) examines and compares the educational achievements of 9-year-old and 13-year-old students in various countries to issue a TIMSS report (Trends in International Mathematics and Science Study) every four years.
- ✓ According to the TIMSS report, Korean elementary and middle school students (K-4 and K-8 graders) have ranked in the top tier in the international evaluation of academic achievements in science and mathematics since the TIMSS Study launched in 1995.
- ✓ Yet despite Korean students' high average scores, their level of confidence and interest in their studies were among the lowest in the world.

STEAM Education in Korea

- Korean students' High Scores but no confidence in Science & Math
- ✓ Main Causes:
 - one-way mechanical transfer of knowledge and rote repetition to memorize information in class
 - abstract knowledge and information unrelated to daily life and actual problems
 - learning mostly focused on solving exam questions



STEAM Education has been introduced in order to get students interested in science and math and to lead them to discover the meaning and value of what they learn by engaging in creative activities and finding connections to the real world.

STEAM Learning Standards Framework

KOFAC developed the 'learning standards framework' of STEAM class to achieve more effectively the goals of STEAM.



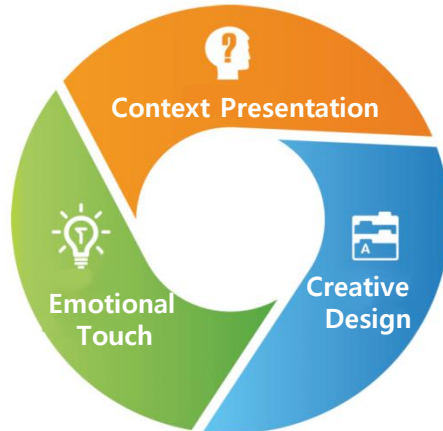
Must include two or more subjects among S, T, E, A, and M



Any subject may be the focus, but must include the content to increase the interest and understanding of science and technology



Must be conducted with the STEAM learning standards frameworks



Context Presentation

to let students recognize problems related to real life



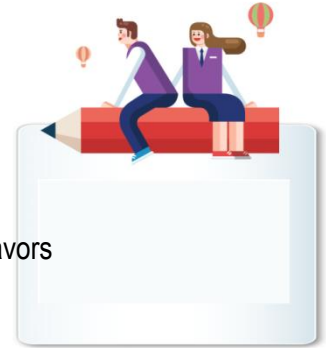
Creative Design

to facilitate students to solve the problems with creative endeavors

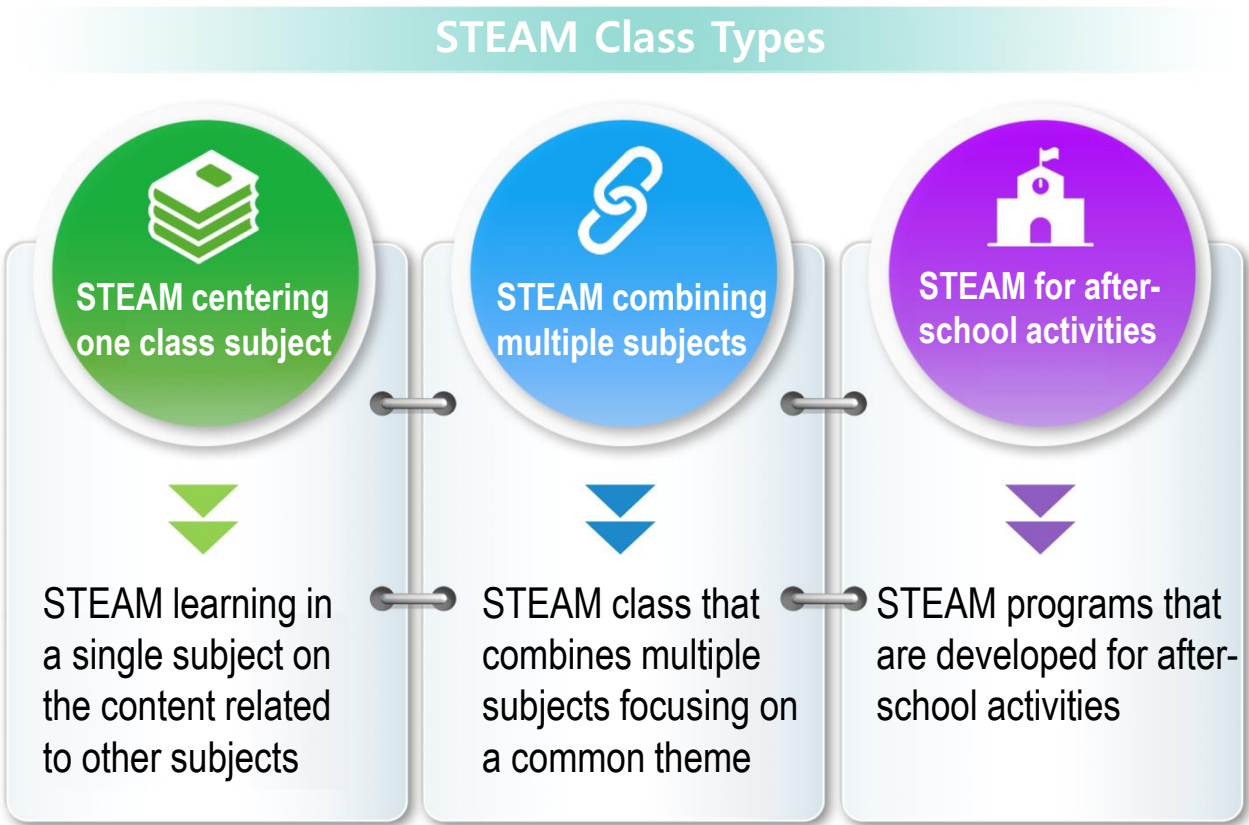


Emotional Touch

to infuse students with interest and motivation to learn by trial and error and take on new challenges



Types of STEAM Class





STEAM Teacher Education System in Korea

STEAM Education Support and Teacher Education System

Policy and Project of KOFAC (Korea Foundation for the Advancement of Science & Creativity)

Support for STEAM Leading Groups

- Support for STEAM Leading Groups: STEAM Leading Schools, STEAM Teachers' Research Groups, Maker Space in School, High school STEAM R&E Project

Teacher Education on STEAM

- STEAM Teacher Training Programs: Introductory program, Foundational program, Advanced program, Overseas training program, Program for Headmasters & Supervisors

Developing Curriculum and Infrastructure

- Developing STEAM Curriculum and Infrastructure: STEAM content in Textbook, STEAM in School Curriculum, Research on National Curriculum, Conference on STEAM Education



STEAM Teacher Training Program (run by KOFAC every year)

STEAM Teacher Education System in Korea

Program	Trainees	Hours	Training Content
Introductory Program	In-service K-12 teachers	15 hours (on-line; throughout the year)	• KOFAC: basic concepts & structure of STEAM
		15 hours (off-line; second half of the year)	• local Education Office: basic concepts & structure of STEAM
Foundational Program	300 in-service teachers	45 hours (on- & off-line; August ~ November)	• KOFAC + Training Center • teaching & learning methods of STEAM class for teachers of non-science-majors
Advanced Program	200 in-service teachers	52 hours (on- & off-line; August ~ November)	• KOFAC + Training Center • advanced STEAM class for teachers of science majors
Program for Headmasters & Supervisors	headmasters, supervisors, and public officers of local Education Dept.	6 hours (off-line; November ~ December)	• KOFAC + Training Center • STEAM education policy and trends, educational leadership



STEAM Teacher Education System in Korea

STEAM Teacher Training: Foundational Program

- ✓ Trainees: 300 in-service K-12 teachers who are interested in developing basic STEAM lesson plan and conducting STEAM class
- ✓ 45 hours of training program: from August until November of the year
- ✓ Training Center: KOFAC + KNUE (Convergence Science-Technology Teacher Training Center 2017-2020)

- Understanding basic premises and structure of STEM education
- Workshop for reorganizing already-developed STEAM class content to create new lesson plans
- Mentoring on developing STEAM lesson plans
- Consulting on conducting STEAM class at school
- Sharing STEAM lesson plans and application results



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STEAM Teacher Training Program for UNITWIN Partners

- ✓ Walking Monster Project: 3 hour on-line STEAM teacher training program

Let's make walking monsters!

understanding the center of mass and the friction force

Instructor: Shin, In Cheol

STEAM Convergence Education for K-7 Students

Science + Mathematics + Art

(Teaching content may be modified according to the grade level)

- followed STEAM Learning Standards Framework
- integrated three elements (context presentation, creative design, emotional touch) into a holistic learning experience



Walking Monster Project

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<What is Walking Monster?>

Walking Monster is an moving object made with simple materials such as paper cups and foam boards. This content is not just about experimenting with the movement of an object. It is an activity where students can have fun by comparing the movements of the objects through a racing game. Furthermore, it provides students with an aesthetic and humanistic opportunity for creative expression by making characteristic figures that reflect their personality on the walking object.



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STEAM Teacher Training Program for UNITWIN Partners

✓ Walking Monster Project: 3 hour on-line STEAM teacher training program

1. Goal

Science & Math concepts + Creative Making & Artistic Expression + Fun & Interest

This project aims to let students understand the relationship between the movement of objects, gravity, friction, and the center of mass. Students learn scientific and mathematical concepts through fun activities of making monsters and playing games.

2. Materials

paper cups, foam board (10mm thick), cork foam board, long toothpicks or skewers, straws, thumbtack or drawing pins, cutter or snap knife, ruler, cellophane tape, varied decorations





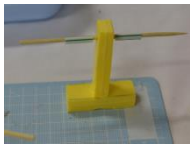
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3. Making

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How to make walking monsters



1. Make a T shape and an I shape using a 10mm foam board. The height of the shapes should be about a half of the paper cup.
2. Punch a hole with an awl in the middle of the paper cup.



3. Put a long toothpick or skewer through the T-shape foam board. Put it through 7mm below the top edge of the foam board.
4. To anchor the toothpick, put in a short straw (cut in the length of 20mm) each side.
[Later on, paste or fasten the straw so that it does not move.]



5. Put the toothpick of the T-shape into the hole of the paper cup.
6. Put the I-shape inside the paper cup at the opposite from the hole. Attach/paste the I-shape so that the tip sticks out a little bit.
7. Insert a pin or tack on the upper part of the paper cup at the back of the T-shape so that the cup adjusts itself with the center of mass.

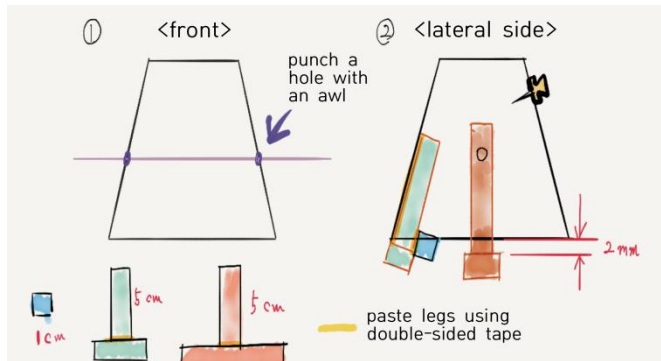


8. Put the monster on the slope and observe whether it walks down.
9. If it stops or does not move, change the position of the pin and try again.
10. When the monster walks down properly, the project has succeeded!
11. You can do a walking monsters' race with friends.



STEAM Teacher Training Program for UNITWIN Partners

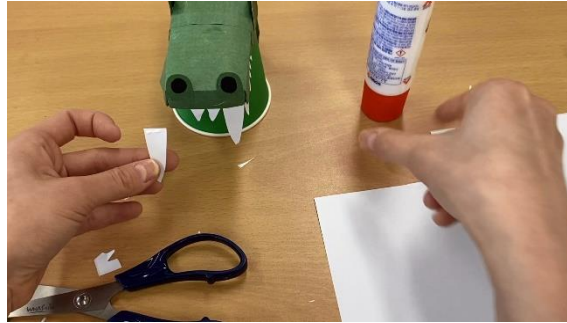
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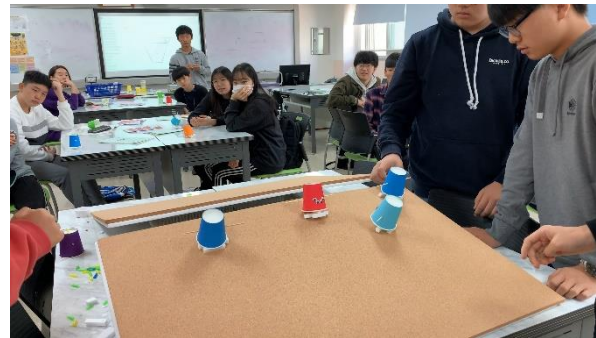
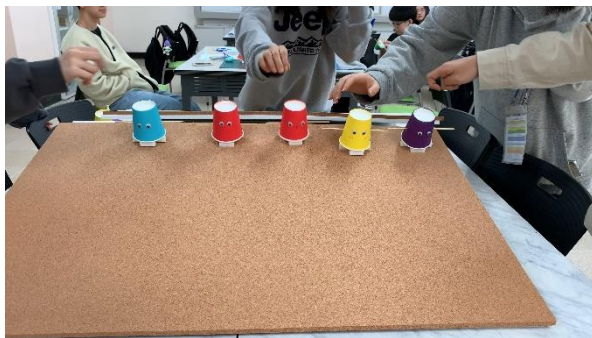




STEAM Teacher Training Program for UNITWIN Partners

4. Walking Monsters Race

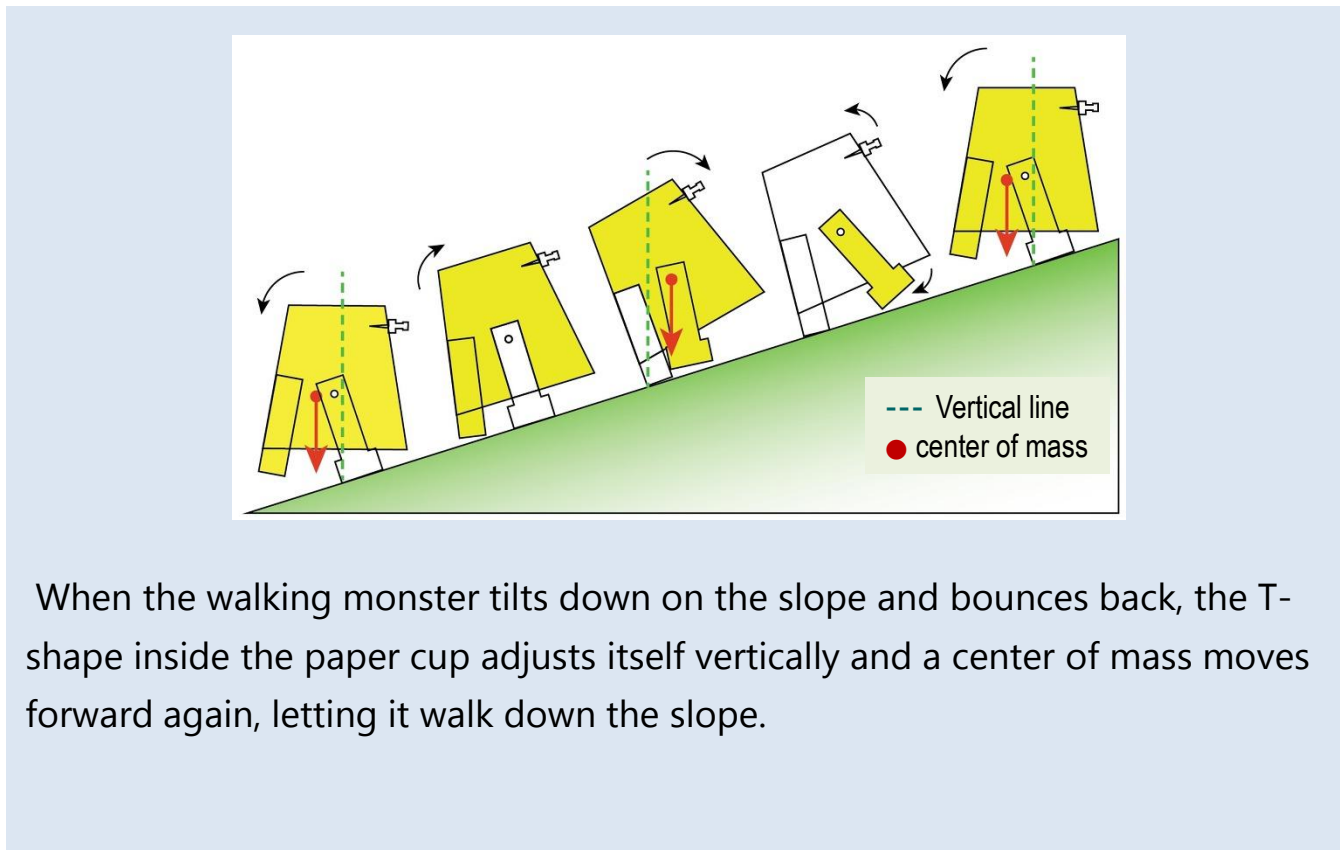
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Walking Monster Project

5. Understanding science and math underlying Walking Monster



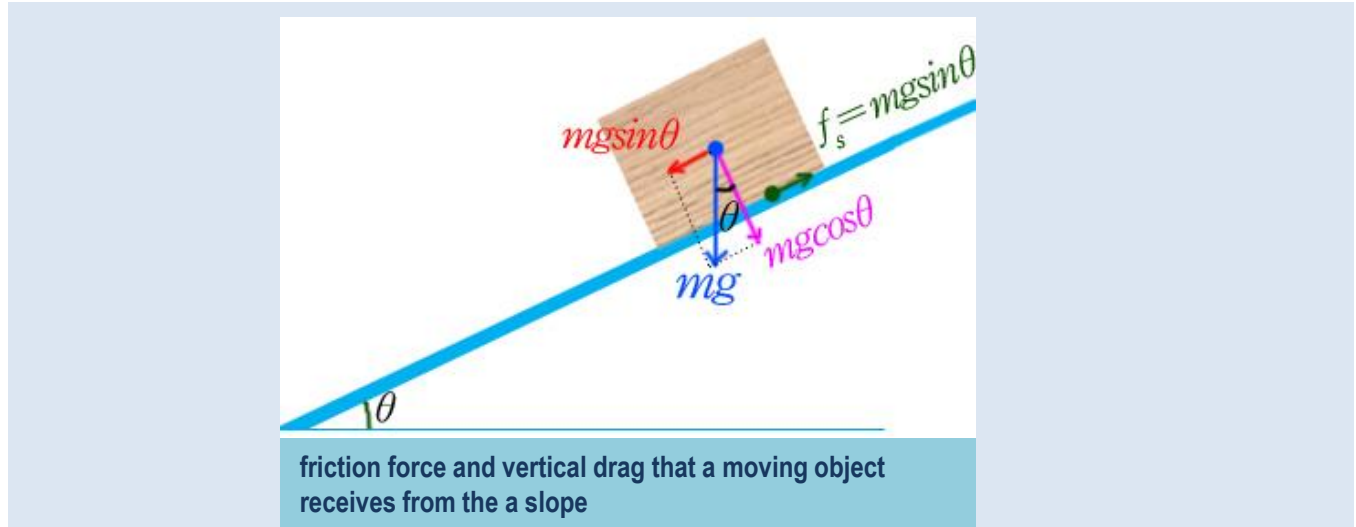
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STEAM Teacher Training Program for UNITWIN Partners

5. Understanding science and math underlying Walking Monster



When an object moves down the slope, various forces including gravity, normal force, air resistance, and friction are exerted on the object. If an object does not slide down on the slope, it is because the force of gravity (allowing things to slide down) and the force of friction between the object and the slope are equalized.

- Teaching content may be modified in accordance with grade level.

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For Further Discussion on STEAM Teacher Education

- ✓ STEAM education should serve to enhance students' interest and understanding in science, technology, engineering, and math through creative activities. STEAM aims to achieve an integration of scientific knowledge and aesthetic experience focusing on problems in the real world.
- ✓ For STEAM teacher education system to be built and fully operated, we need to continue discussion on curriculum development, teacher training program development, and a long-term teacher education system in UNITWIN partner countries.

Thank You!