IT in Education Subject-related Series:

Using 3D-Printing Technology and e-Learning Tools to Enhance Learning, Teaching and Assessment of Science (S1-3) Curriculum

Session 1

資訊科技教育
Information Technology in Education

PEAK
Member of VTC Group
VTC 機構成員

Objectives

Session 1

Using 3D-Printing technology for conducting scientific investigation

- Use of e-Learning platform (e.g. Schoology)
- Overview of the strategy for using 3D-Printing technology and digital tools in scientific investigation
  - Use of e-Learning tool (e.g. AnswerGarden)
  - Use of PhET simulations tool (e.g. energy forms and changes)
- Introduction of 3D-Printing technology
- Design 3D objects for scientific investigation (each participant is required to choose a 3D design task)
- Discussion on the assignment

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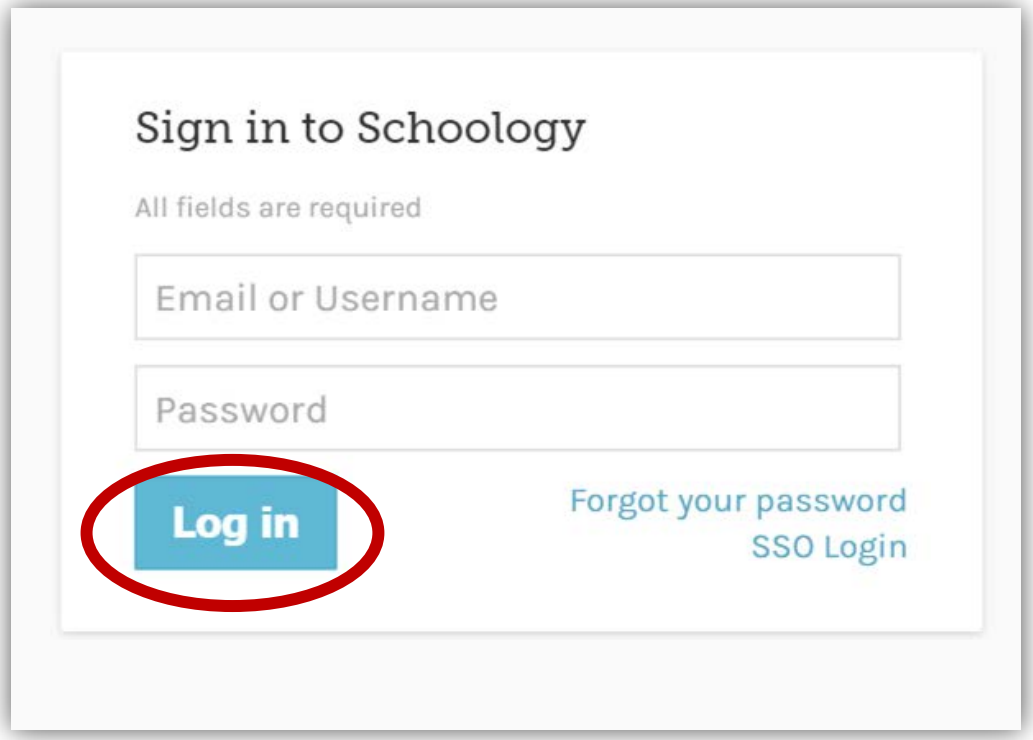
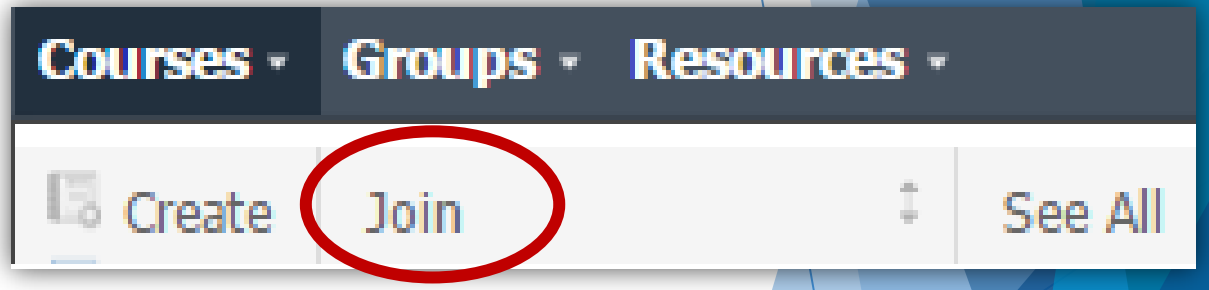
Login the e-Learning Platform

- http://www.schoology.com
- Log In: using your own schoology account
- Course Code: KJ38Z-WNBWP

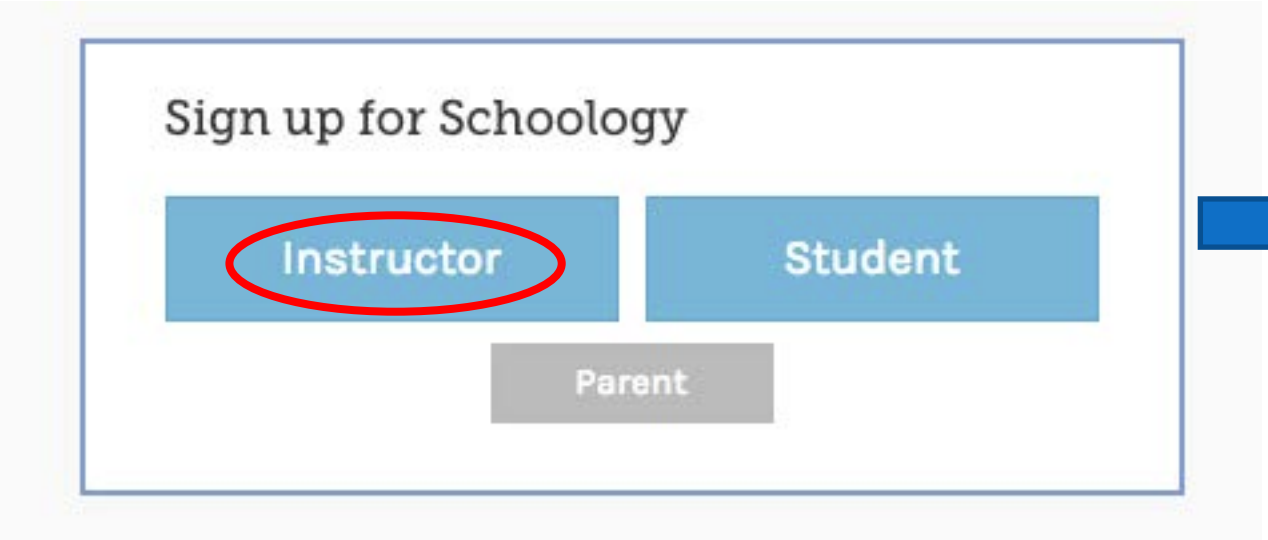


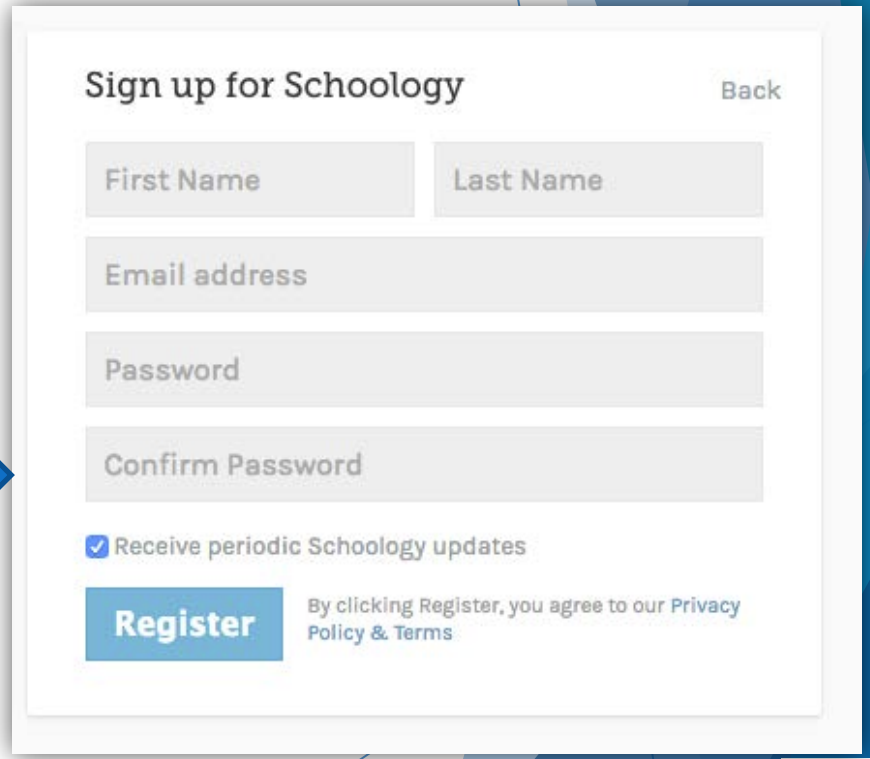


e-Learning Platform

Sign up as an instructor

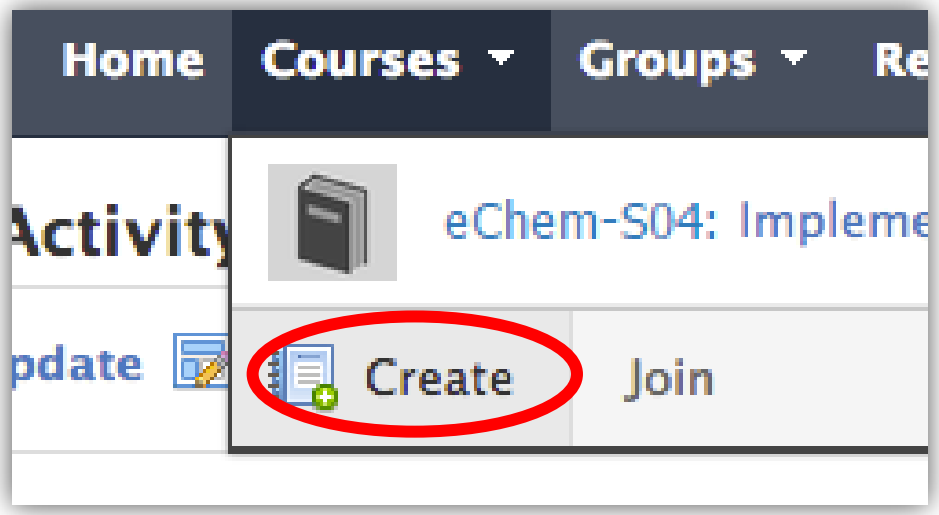
- Sign Up: using your personal email to sign up as an instructor





e-Learning Platform

Create course

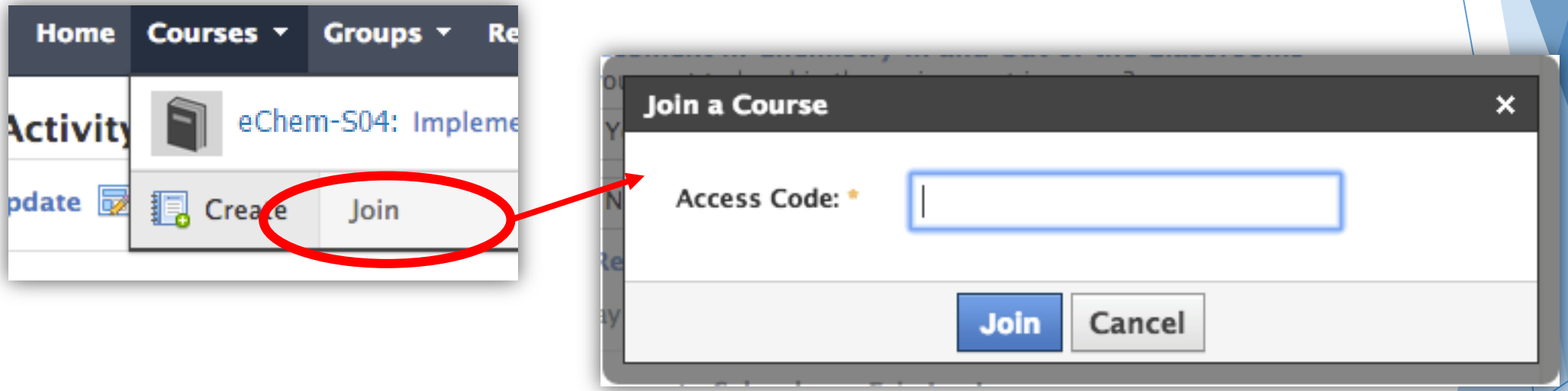


Mark down your course code

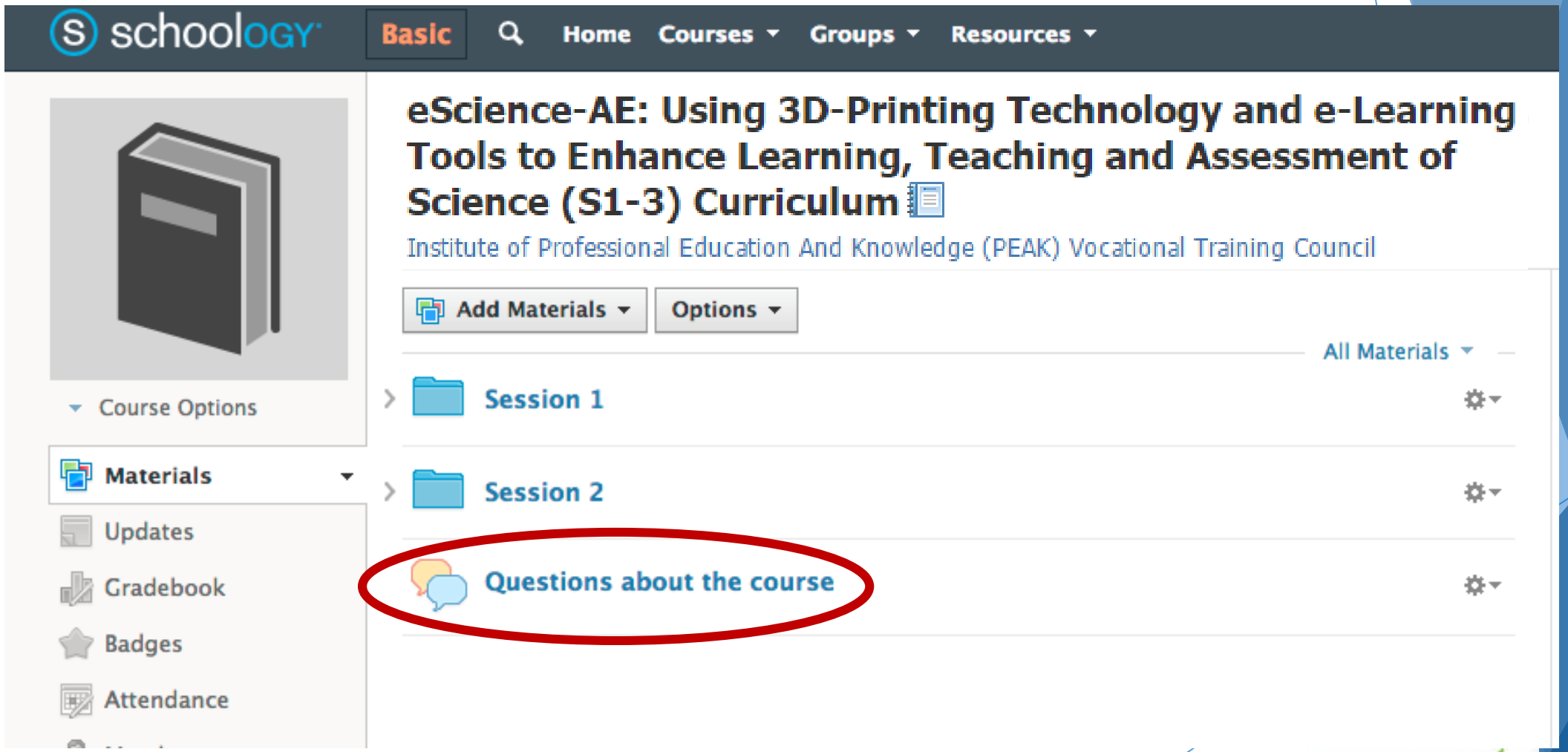
- Create your own content and resources

e-Learning Platform

- Use a test account to join the course you created

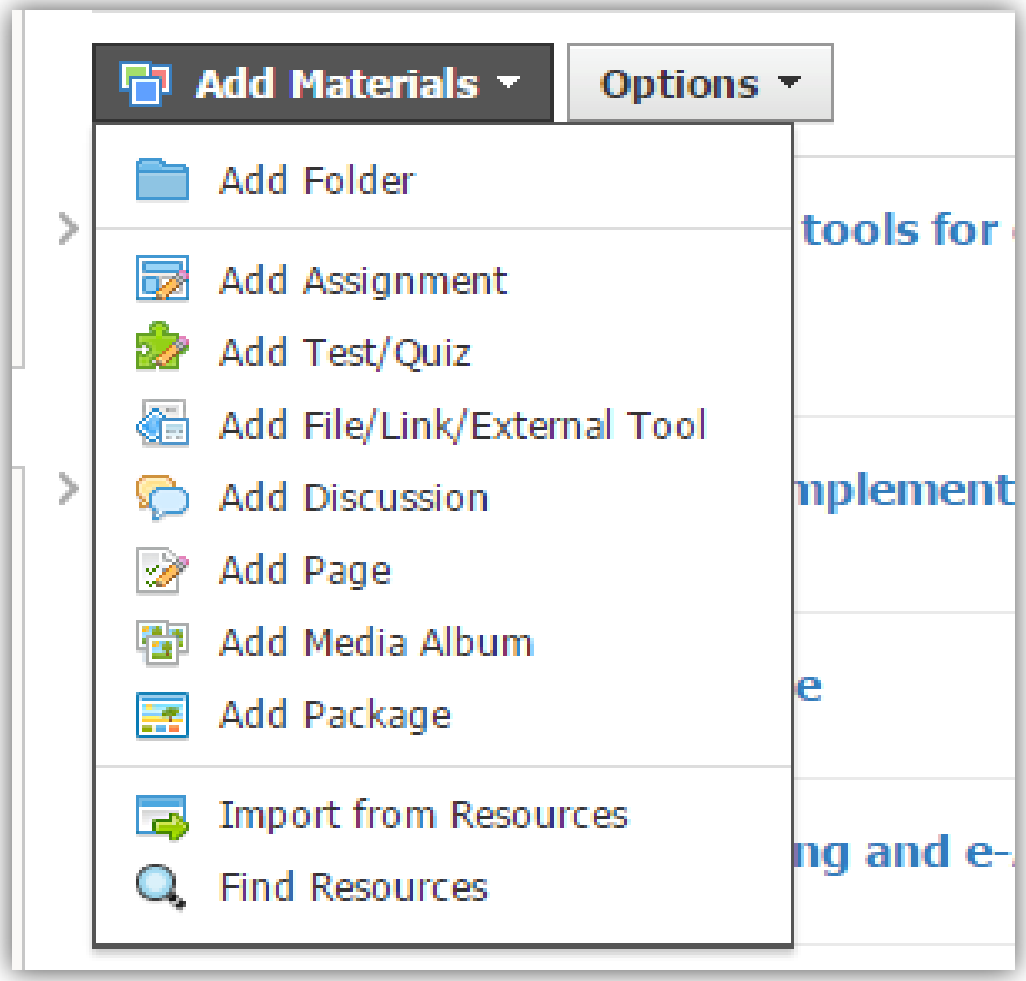


Ask Questions



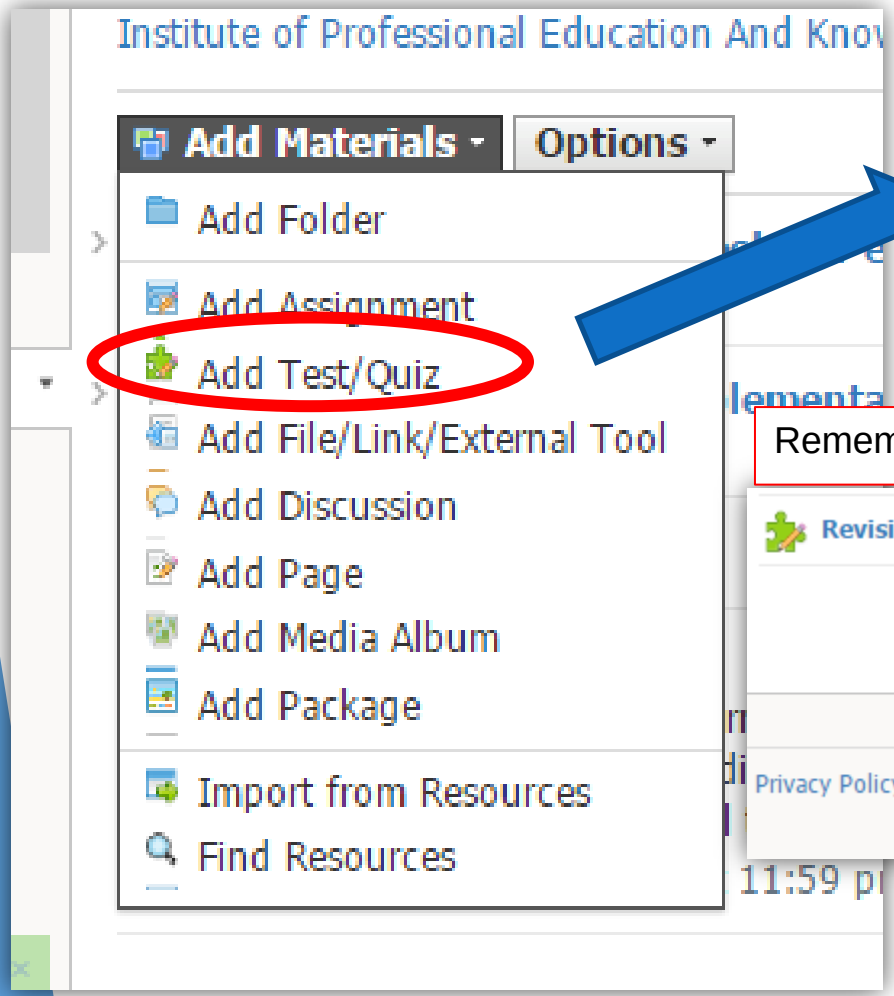
schoology e-Learning Platform

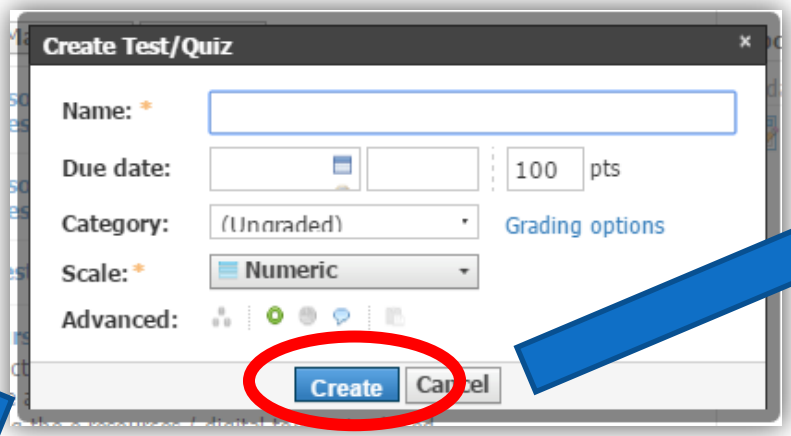
Overview of features

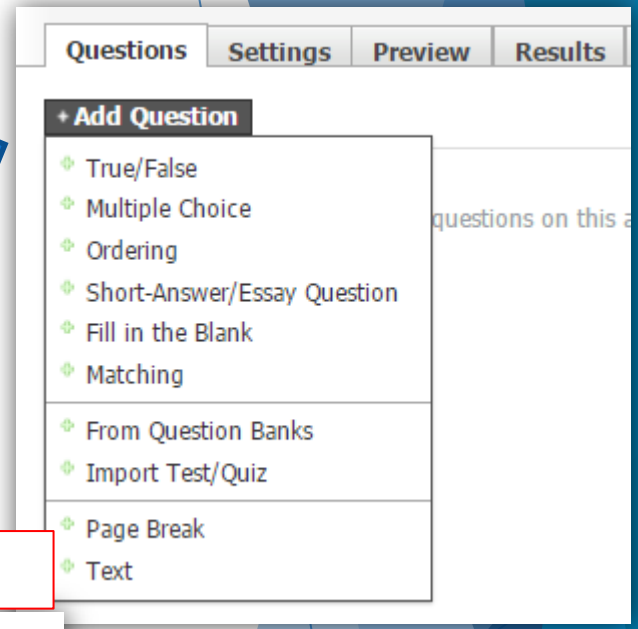


schoology e-Learning Platform

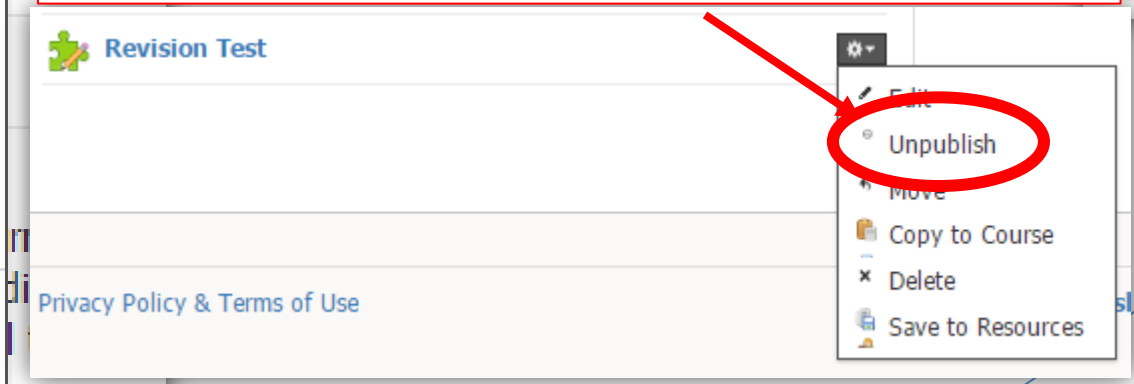
Setting Test / Quiz





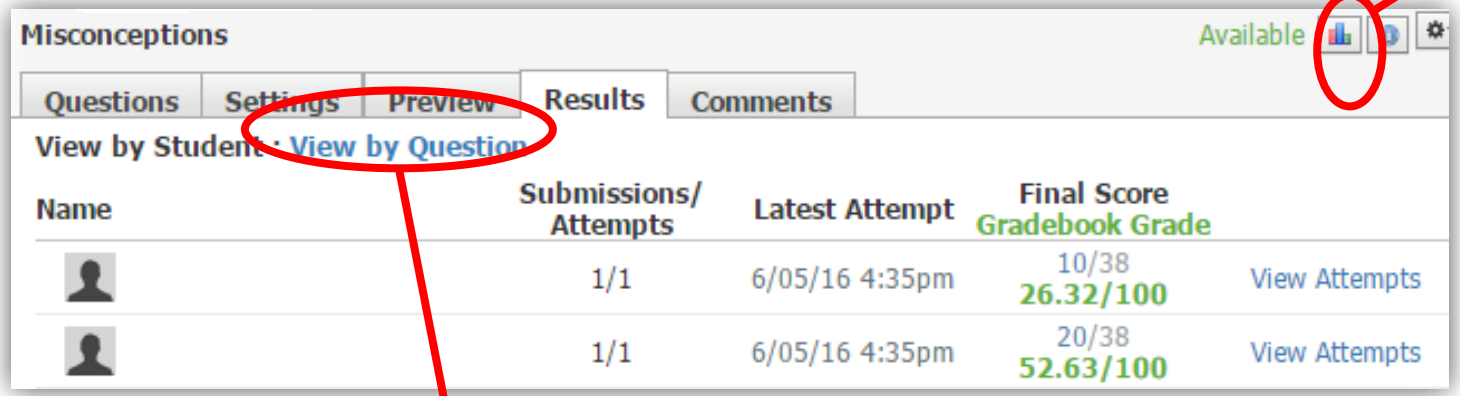


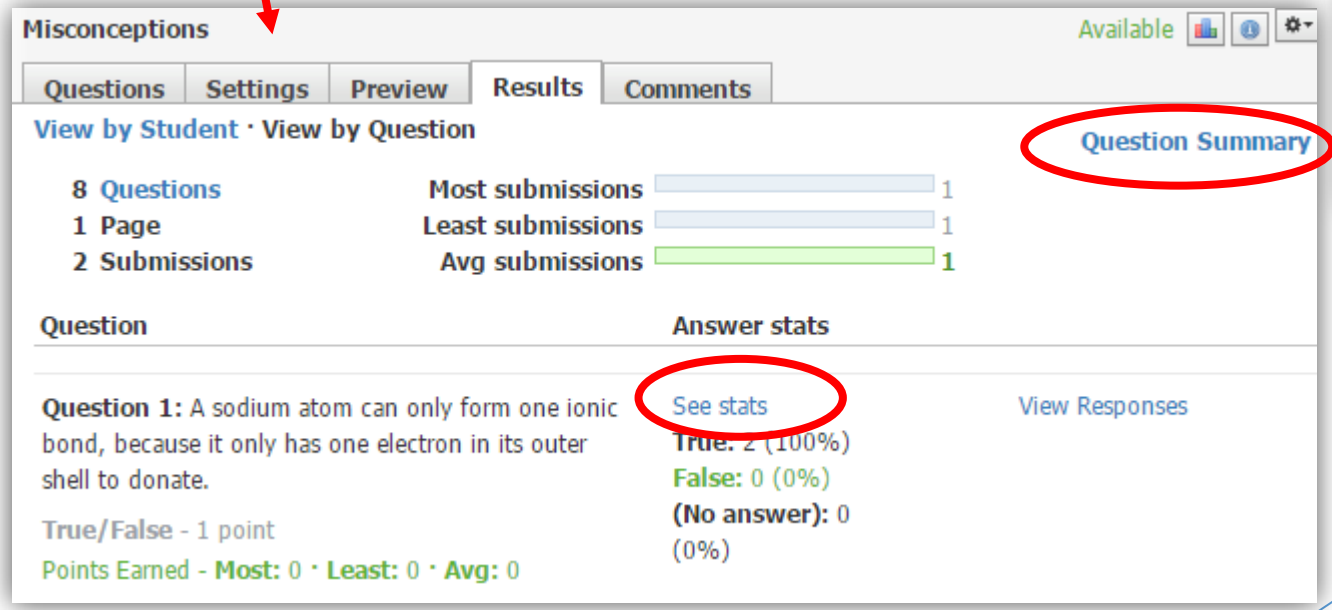
Remember to publish your test/quiz to students

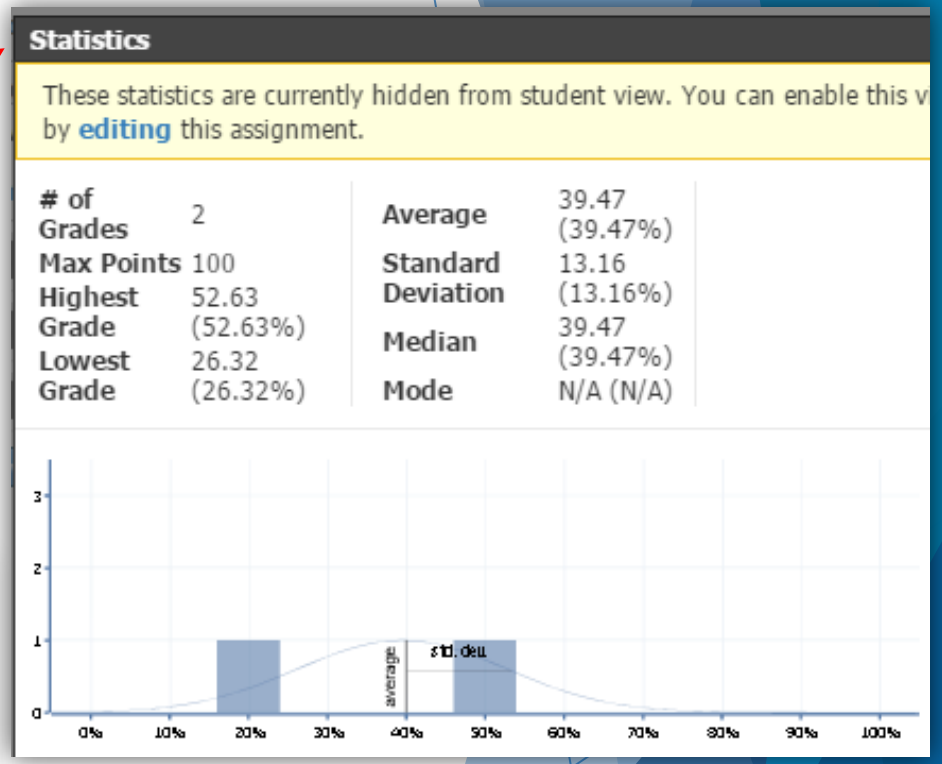


e-Learning Platform

Setting Test / Quiz

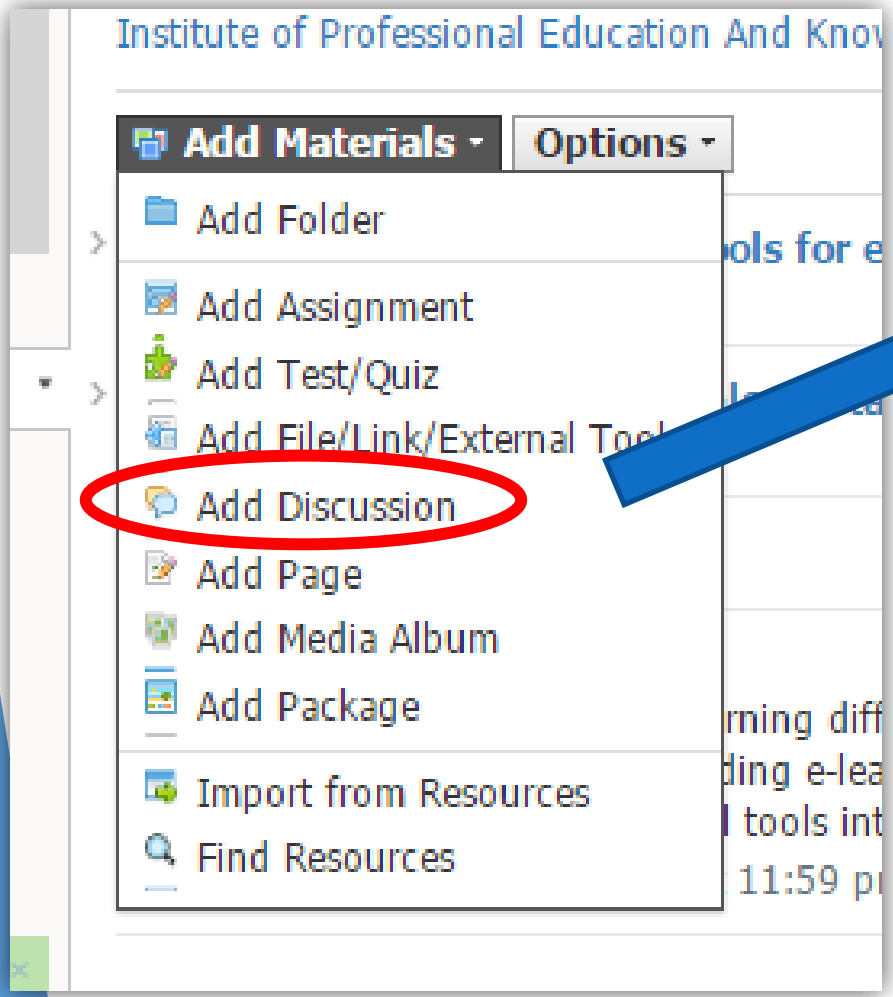


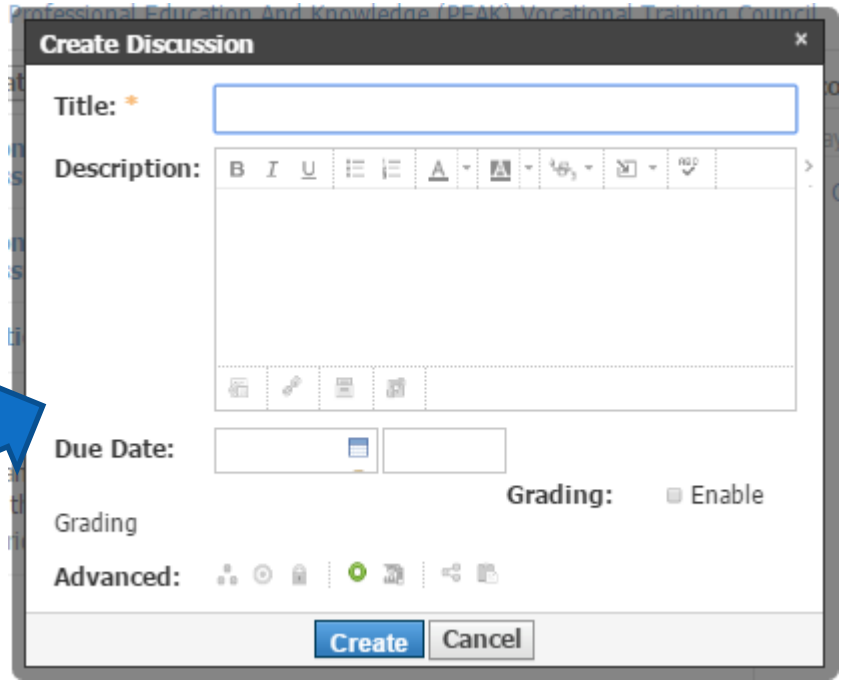


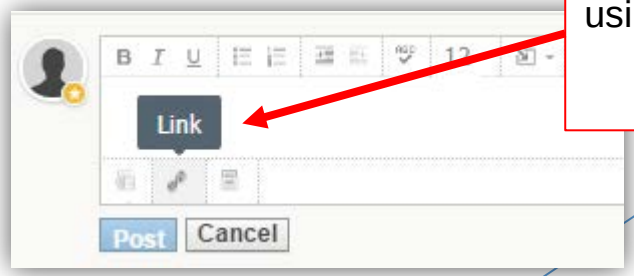


schoology e-Learning Platform

Setting Discussion



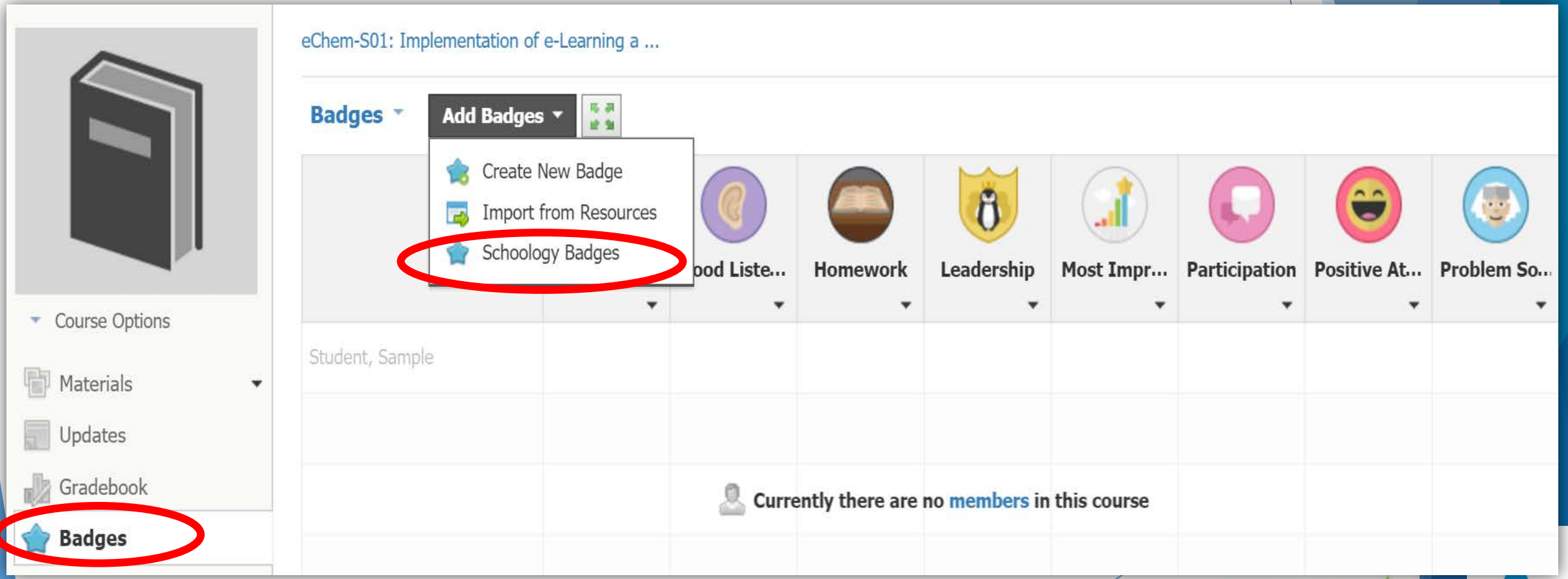




Can search and attach link to comment when using computer, but not mobile phone

schoology e-Learning Platform

Giving badges



Why using 3D printing in scientific investigation?

What can 3D printing do?

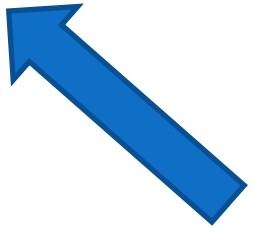
eScience-AE: Using 3D-Printing Technology ...

Session 1

Add Materials | Options

Use of 3D in scientific investigation

Scientific investigation



E-learning tools

3D printing technology

Stages of scientific investigation

Setting a question	What are we investigating and why?
Proposing a hypothesis	What do we know about the topic?
Designing a fair test	How can we test it? Any reference?
Carrying out the experiment	What do we need? How can we collect data?
Analyzing results	How do we analyze the data?
Drawing conclusion	
Presenting the findings	How is a better way to present the findings?

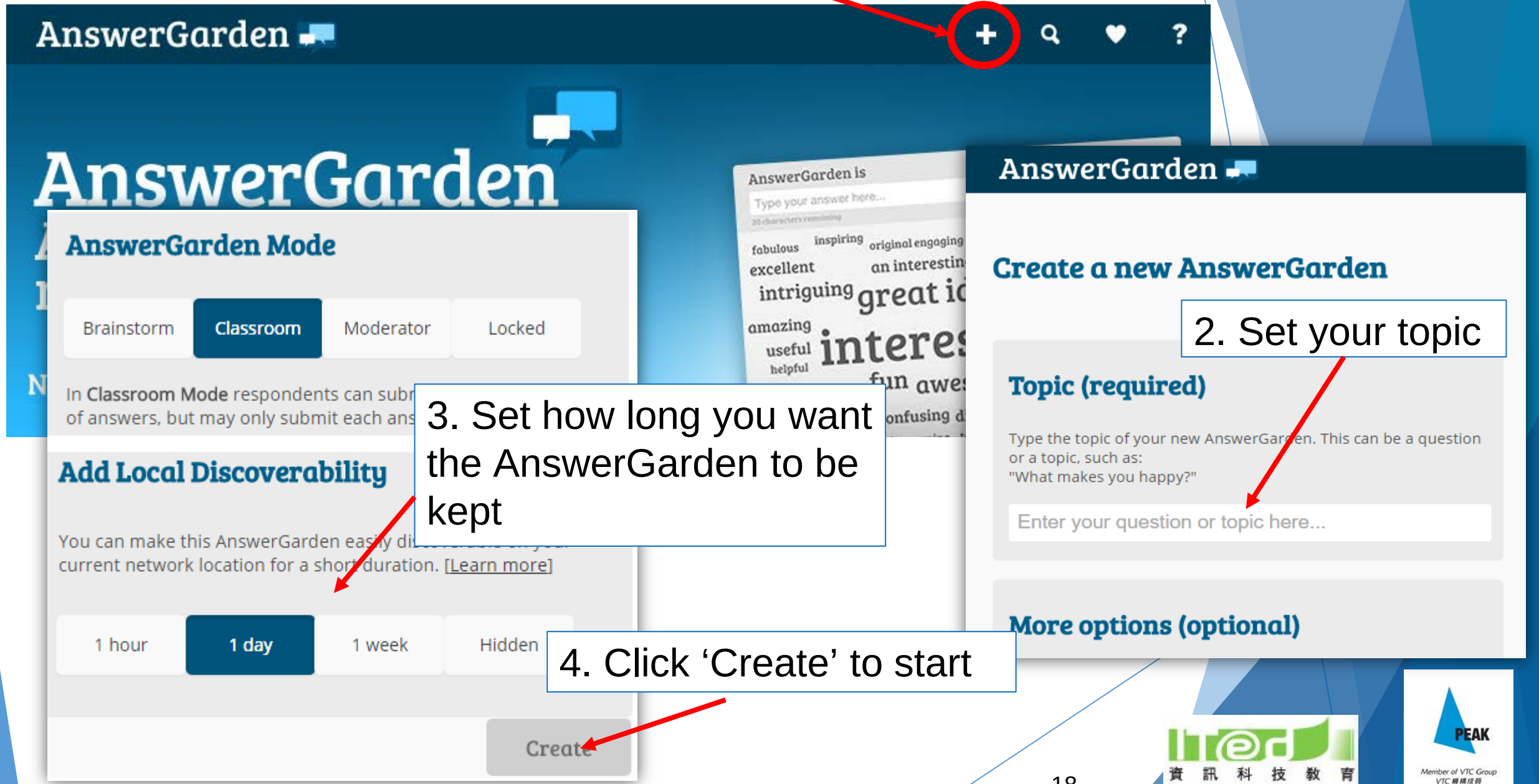
How do we usually start a scientific investigation?

AnswerGarden

https://answergarden.ch/

- Real time brainstorming tool
- √No need to sign up
- √Answers can be exported as image in PNG format (the answers can only be stored for a short period of time in the platform)

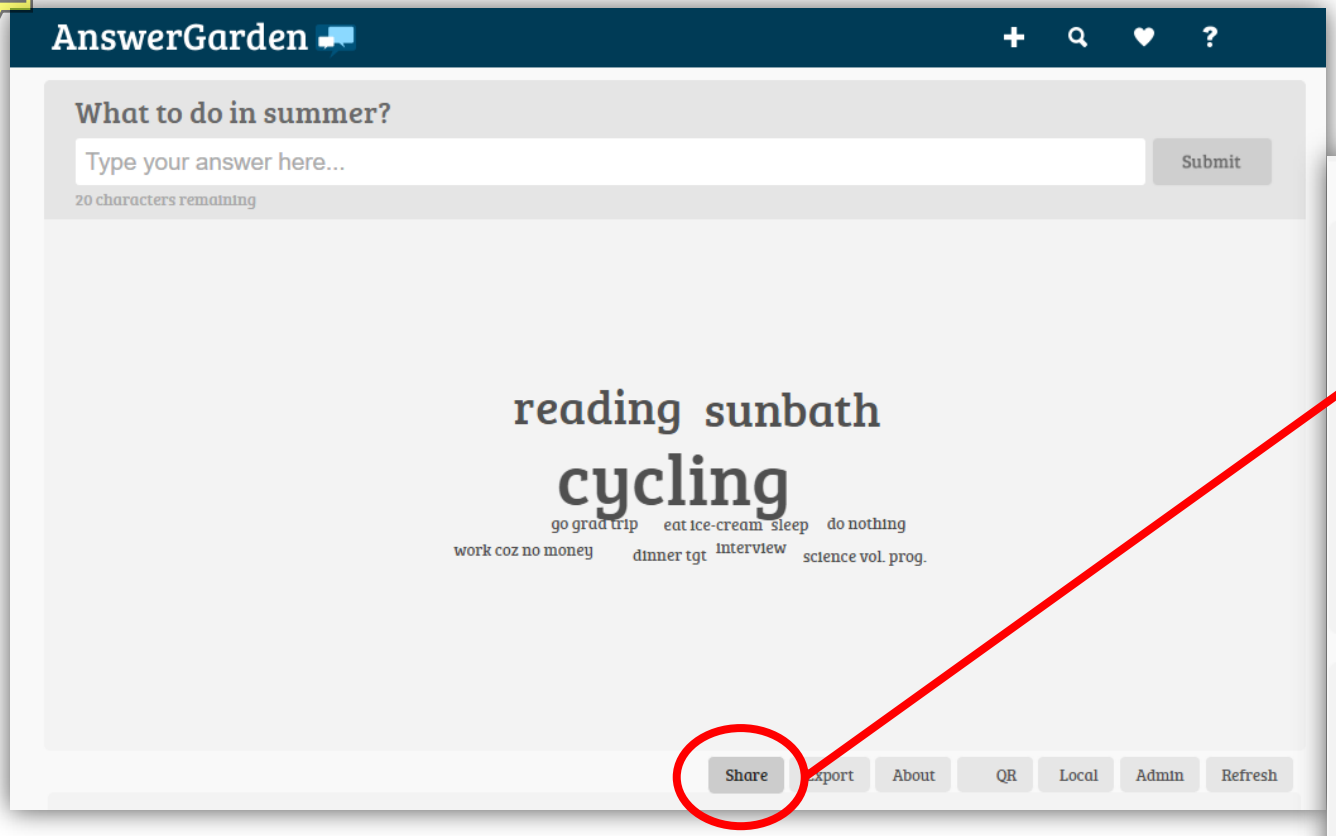
1. Click the + sign to open a new AnswerGarden

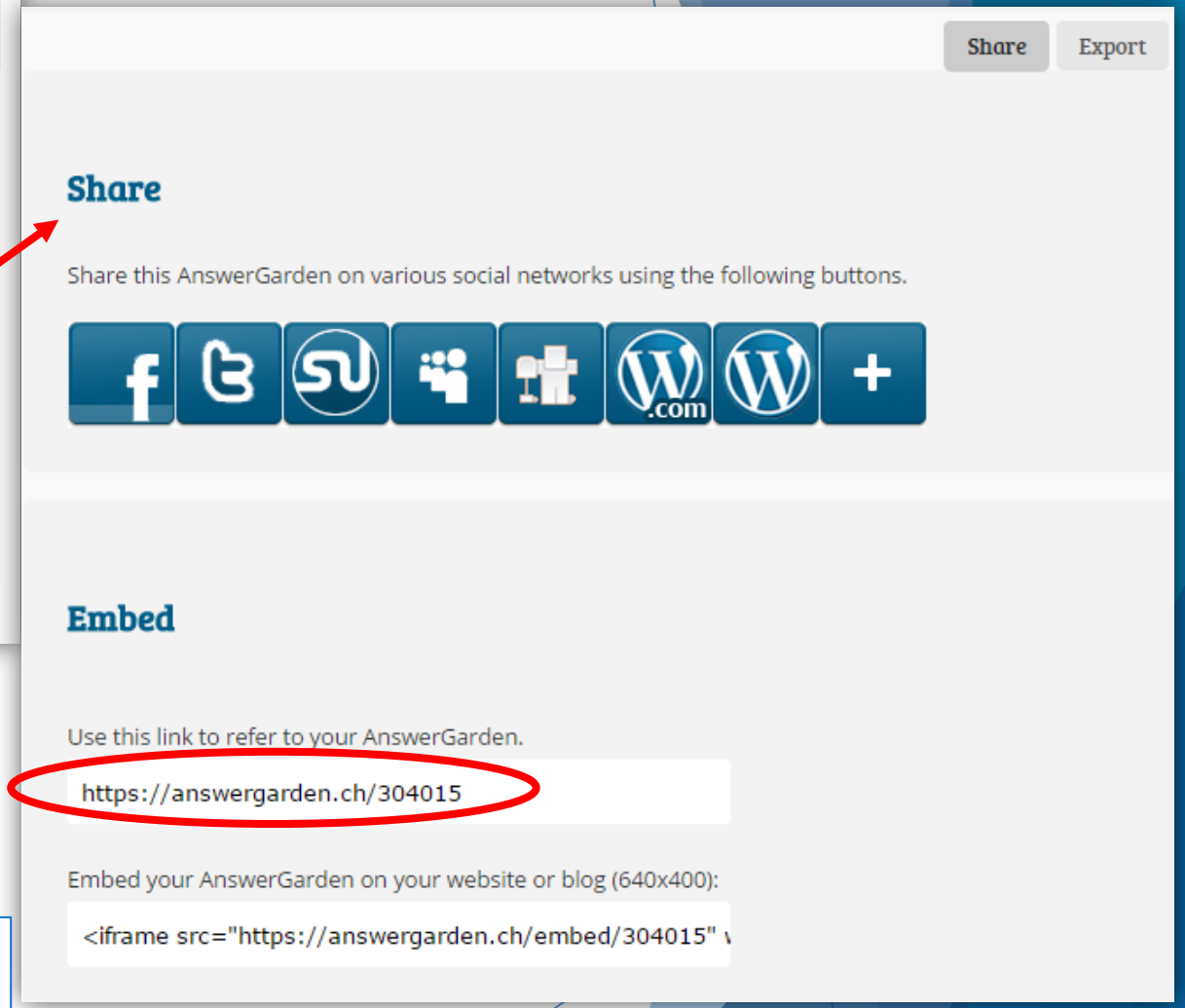


2. Set your topic

3. Set how long you want the AnswerGarden to be kept

4. Click ‘Create’ to start





5. Share this link with others

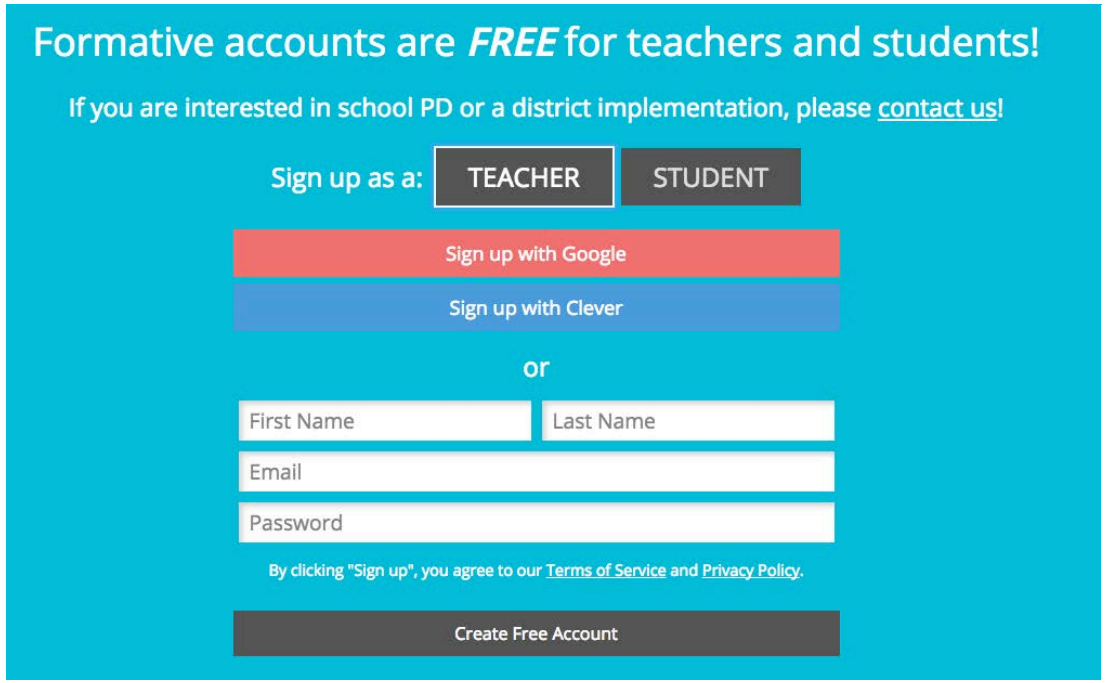
formative

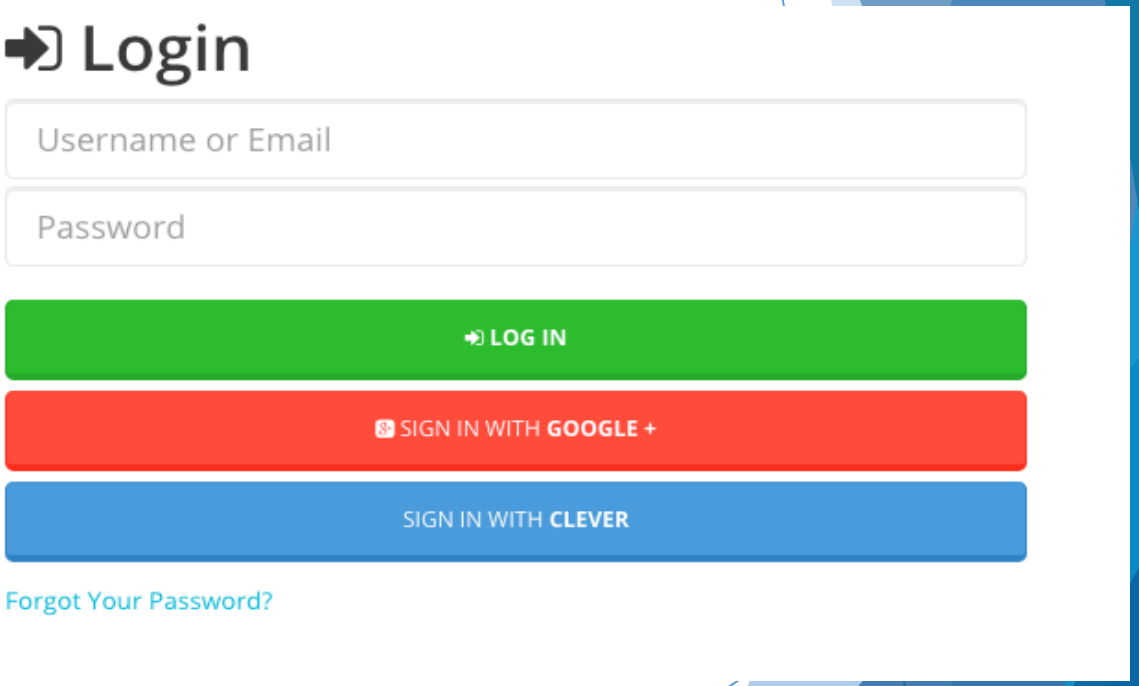
https://goformative.com/

- Collect students' live responses
- √Give feedback to and grade students' answers
- √Elaborated answers and drawing allowed
- √Easy to set

formative

- Sign up an account as instructor





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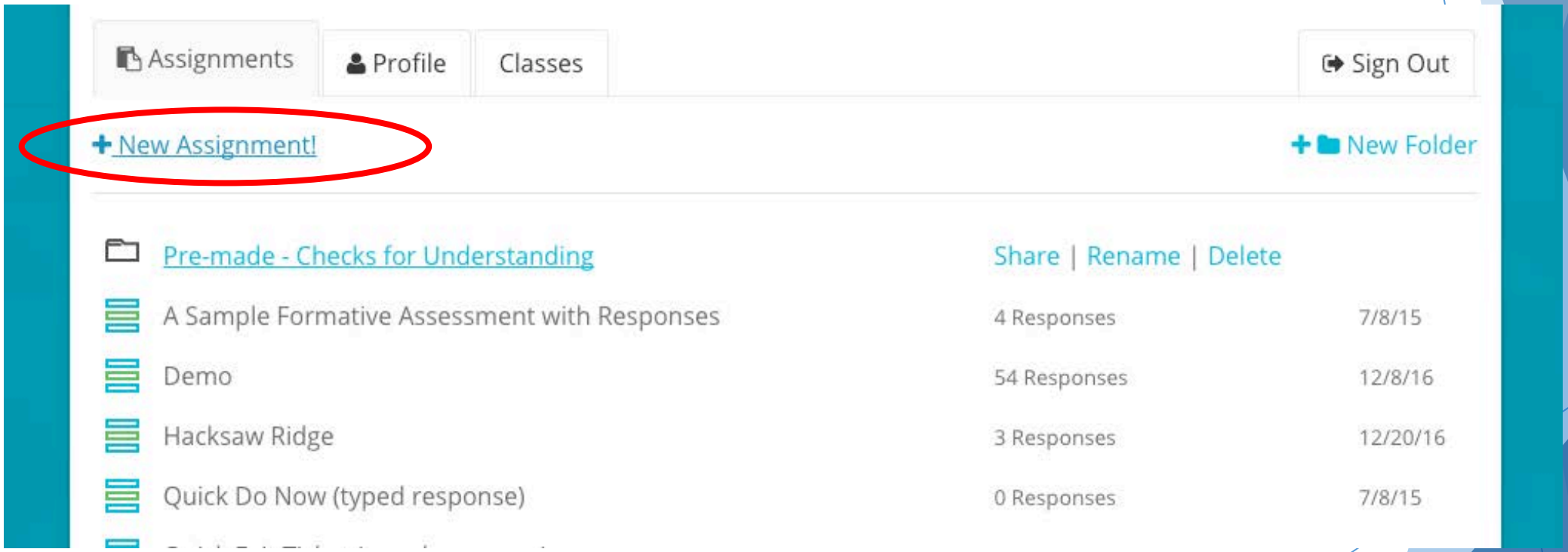
- Create questions to collect responses



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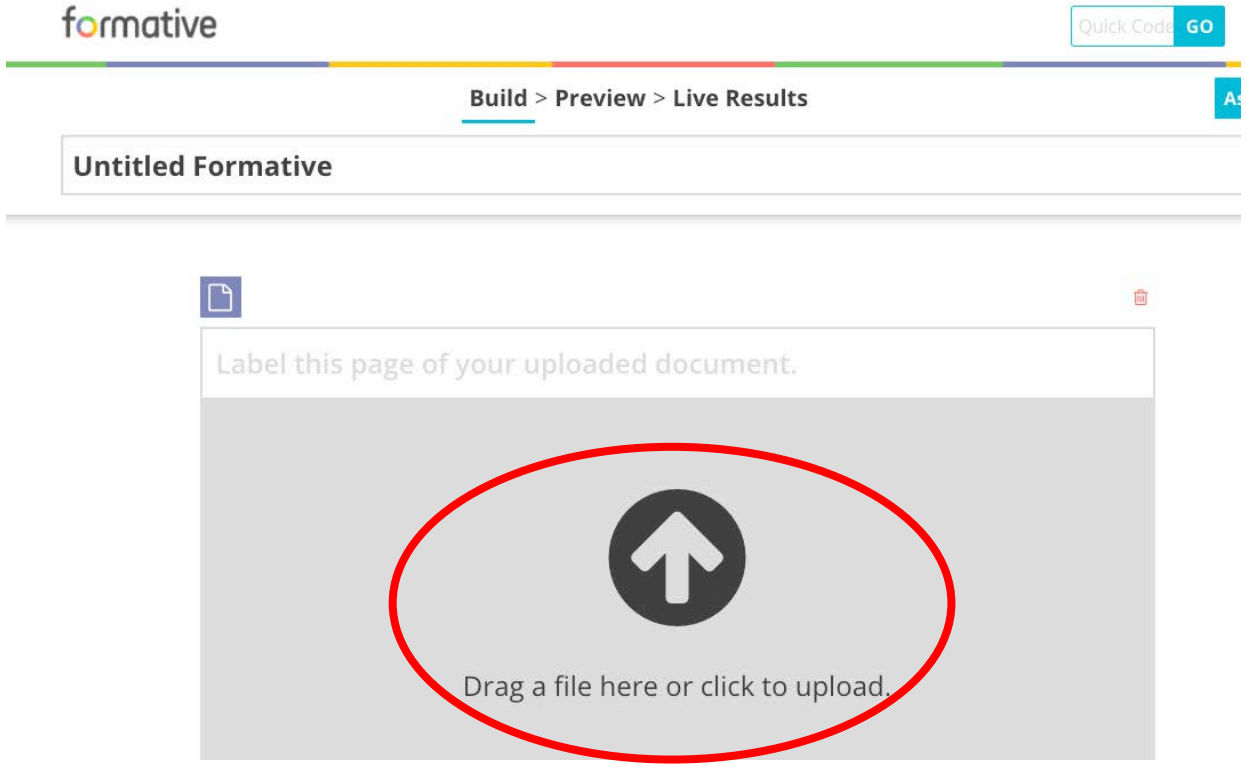
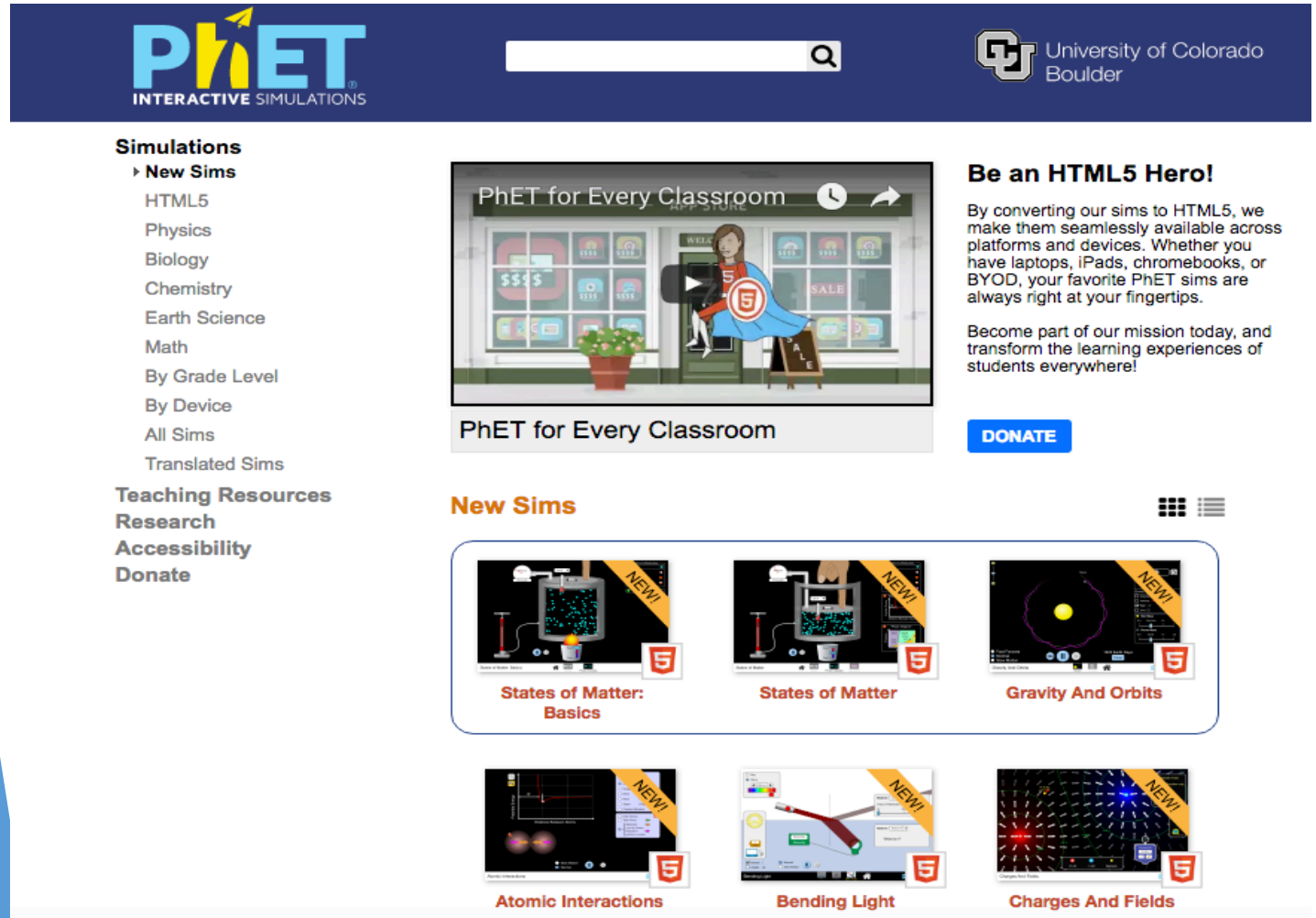
- Base on your existing worksheets to create questions



https://phet.colorado.edu

Simulation on varies concepts

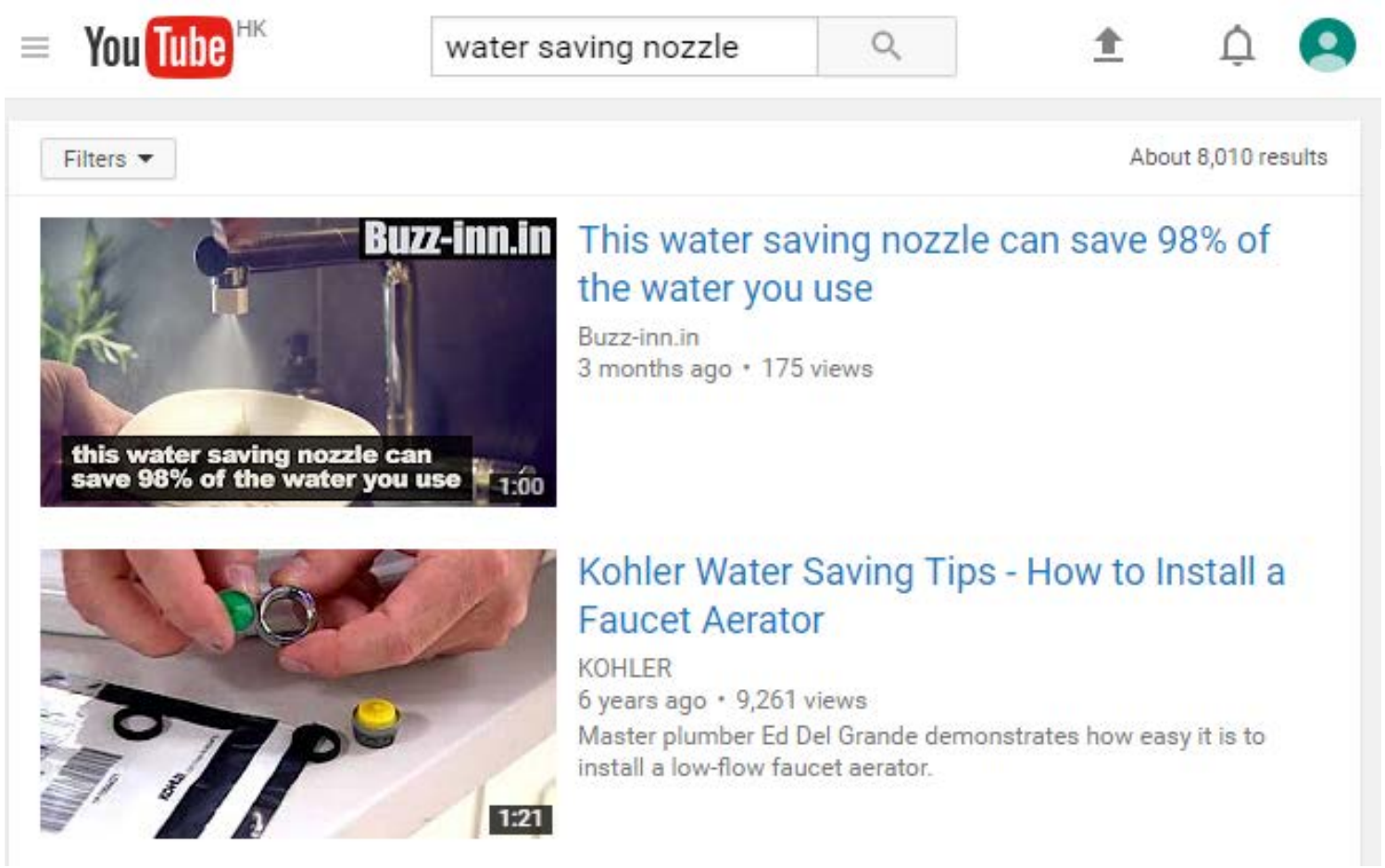


√Illustrative

√Interactive

√Convenient

https://www.youtube.com/



√resourceful

- Check content before use
- Pop-up advertisement

EDpuzzle

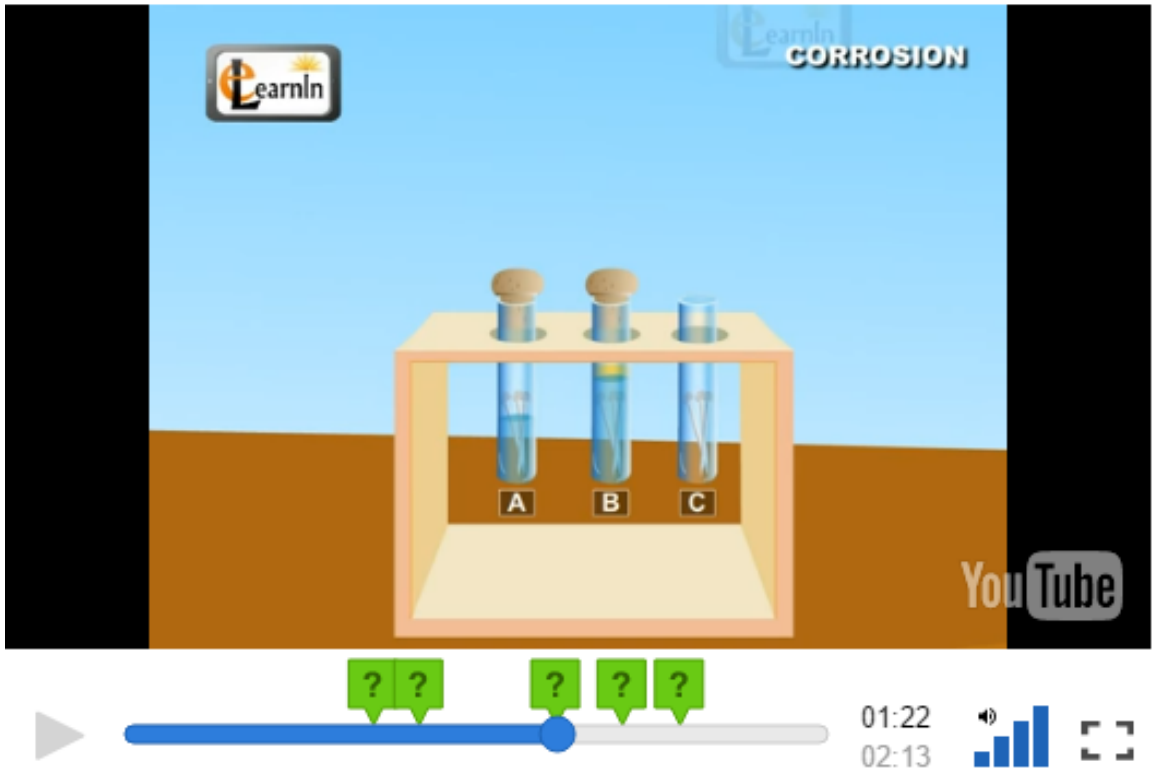
https://edpuzzle.com/

√Interactive video

❖Analysis of students' responses

❖Free of charge and easy to use

Corrosion and rust- Science



What is the difference between tap water and distilled water?

Why is the difference between distilled water and boiled distilled water?

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2 Examples of scientific investigation

Topic 1:

Turbine design
&
Hydroelectricity

Topic 2:

Water Tap design
&
conservation of water

Scientific investigation 1:

Turbine design
&
Hydroelectricity

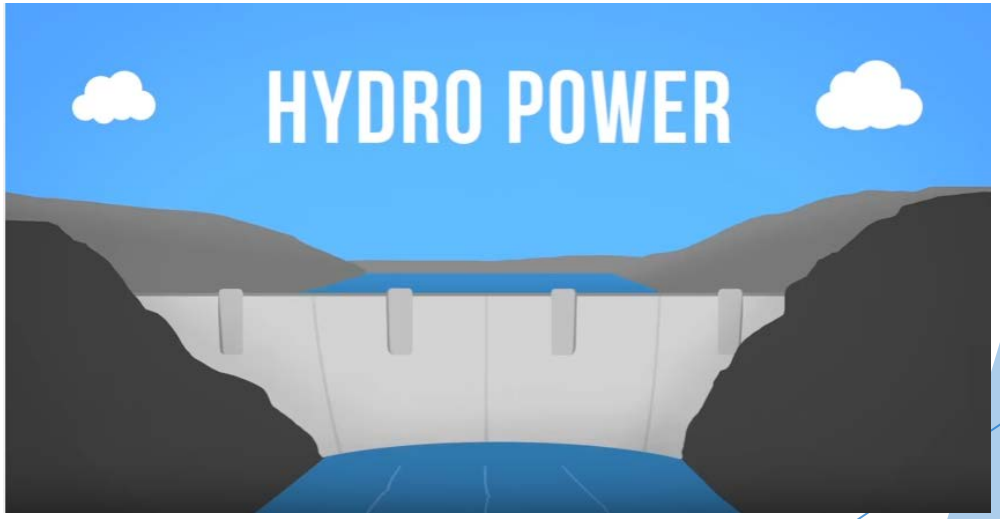
Turbine design & Hydroelectricity

Unit 2 Energy

Topics	Key points	Content		Suggested Activities
		Core	*Extension*	
4.4 Generating electricity	Generation of electricity *Hydro-electric power* *Wind power* *Nuclear power*	Electricity is the most common energy source used at home Electricity is generated in power stations from coal, oil or natural gas in HK; pollution problems arising from the generation of electricity	*Other ways to generate electricity: e.g. hydro-electric power, wind power, nuclear power, chemical cell and solar cell*	T Generate electricity using a steam engine model *T. Generate electricity using a hydro-electric power model* *S. Generate electricity with a solar cell or home made chemical cells*

Introduction

- Generate Electricity from water current:
- WHY ?
  Hydro Power is an alternative energy source (Our Daily Need)

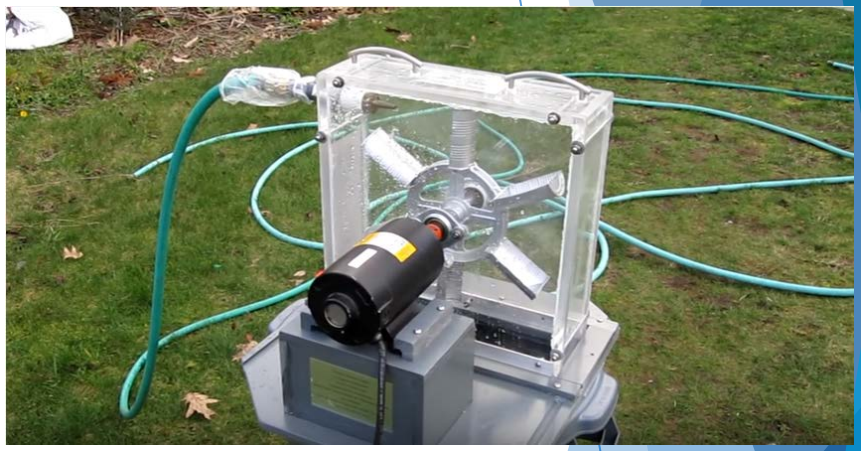


Background knowledge

Pelton Wheel like turbine is chosen as reference...

Working Principle :

Example :

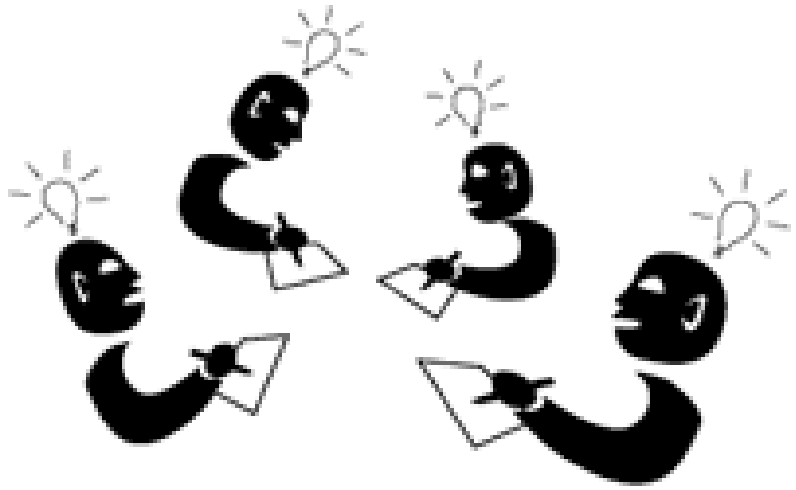


Low speed water Current + Water tight chamber
= feasible in Classroom

Design of investigation

What factors are affecting the efficiency of this type of turbine ?

Let’s brainstorm …



Design of investigation

AnswerGarden

Brainstorm Tool :

identification of students' prior knowledge and interested topics

- Let students answer the question: "What factors affect the speed of a turbine?"
- Then summarize students' ideas in the form of a concept map.

Design of investigation

Factors affecting the efficiency of this turbine :

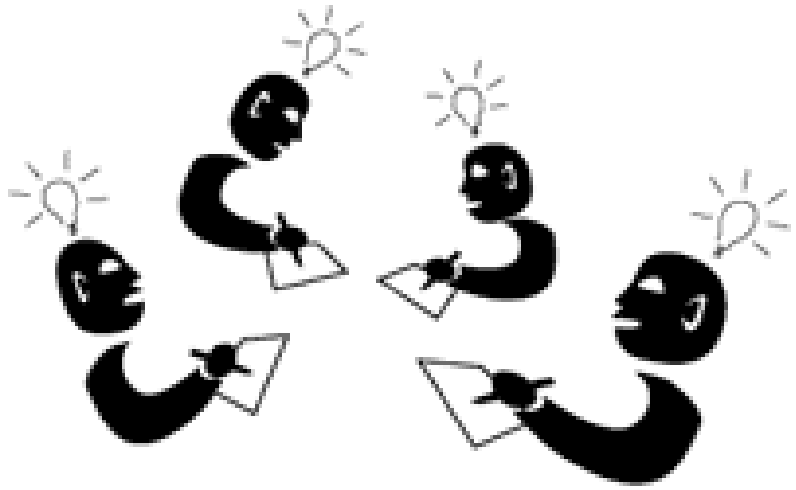
- No. of flips  (0:00-0:20)
  (4:00-4:20)

- Size of flips

Design of investigation

How to measure the efficiency of energy conversion of a Pelton Wheel ?

Let's brainstorm …



Design of investigation

Related Simulations : PhET simulations

e.g. Unit 2 Energy:

- Energy forms and changes (https://goo.gl/4QUr9N)
- Generator : (https://phet.colorado.edu/en/simulation/legacy/generator)

Design of investigation

Exemplars / Reference

Practicability

Originality

Fun

Creativity

Design of investigation

Investigations on the energy-generating efficiency of a turbine:

Investigation	Independent Variable	Dependent Variable
1	Number of paddles	Average voltage generated
2	Size of paddle	Average voltage generated

Concept of fair test

Scientific investigation 2:

Water saving faucet

Water saving faucet

Unit 2 Water

Students should learn	Students should be able to	Suggested Learning and Teaching Activities
2.5 Water conservation and pollution • Conservation of water	• Recognise the importance of water conservation and the ways to conserve water	• Perform a survey in class to find out the daily water consumption at home and suggest ways to reduce the wastage of water • Design and make a device to be fixed on water tap to conserve water in daily use

Introduction

- Water saving tips:
  - Fix dripping water taps ← Not to waste water
  - Close the water tap when brushing teeth ← Reduce the use of water
  - **Use of water saving faucet ← Use water more efficiently**

Introduction

Water saving faucets available in the market:

How much water can be saved by using these?

Background knowledge

How much water can a Eco365 water saving faucet save?

www.neosystek.com

Up to 75% Less Water with 'Shower Type Aerator'

Shower Type Aerator

On Taps/Faucets our Water Saving Eco365days 'Shower Type Aerator' with flow of 2 to 4 LPM (Liters Per Minute) uses up to 75% less water and energy than a standard flow of 10 - 15 LPM aerator. That's saving of 58400 Liters of water annually for a family of 4..

Easy To Install
(Do It Yourself)

Instant Water Flow Reduction

Retrofit existing faucet with Water Saving Aerator and you save water without sacrificing on performance Shower Type Aerator available at flow rate of 1.5, 2, 3 & 4 LPM

Background knowledge

How much water can a YOCOS water saving faucet save?

Design of investigation

Does the design of the filter affect its water saving performance?

Design of investigation

What measurement can we make to show the water saving performance of a faucet?

- Measure the water flow, i.e. litre of water per minute, of the water saving faucet

Design of investigation

What else would you consider when deciding whether or not to use a water saving faucet?

- Water flow
- Water pressure

Low water flow + Low water pressure

OR

High water flow + High water pressure

OR

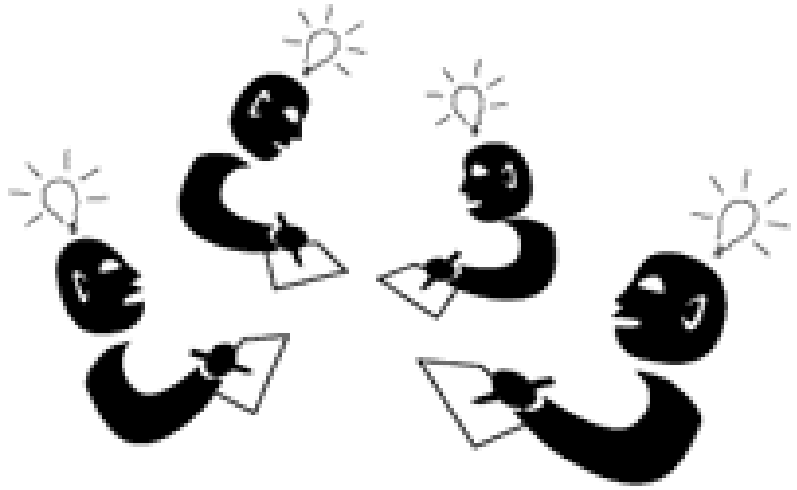
Low water flow + High water pressure

?

Design of investigation

How can we compare the water pressure of different water saving faucets?

Let's brainstorm …

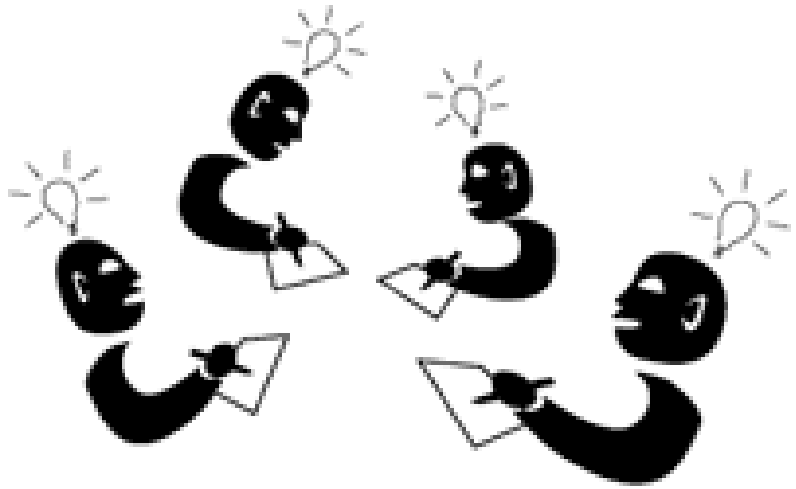


formative

Design of investigation

How can we compare the water pressure of different water saving faucets?

Let's brainstorm …



Will the design of filter affect the water pressure?

formative

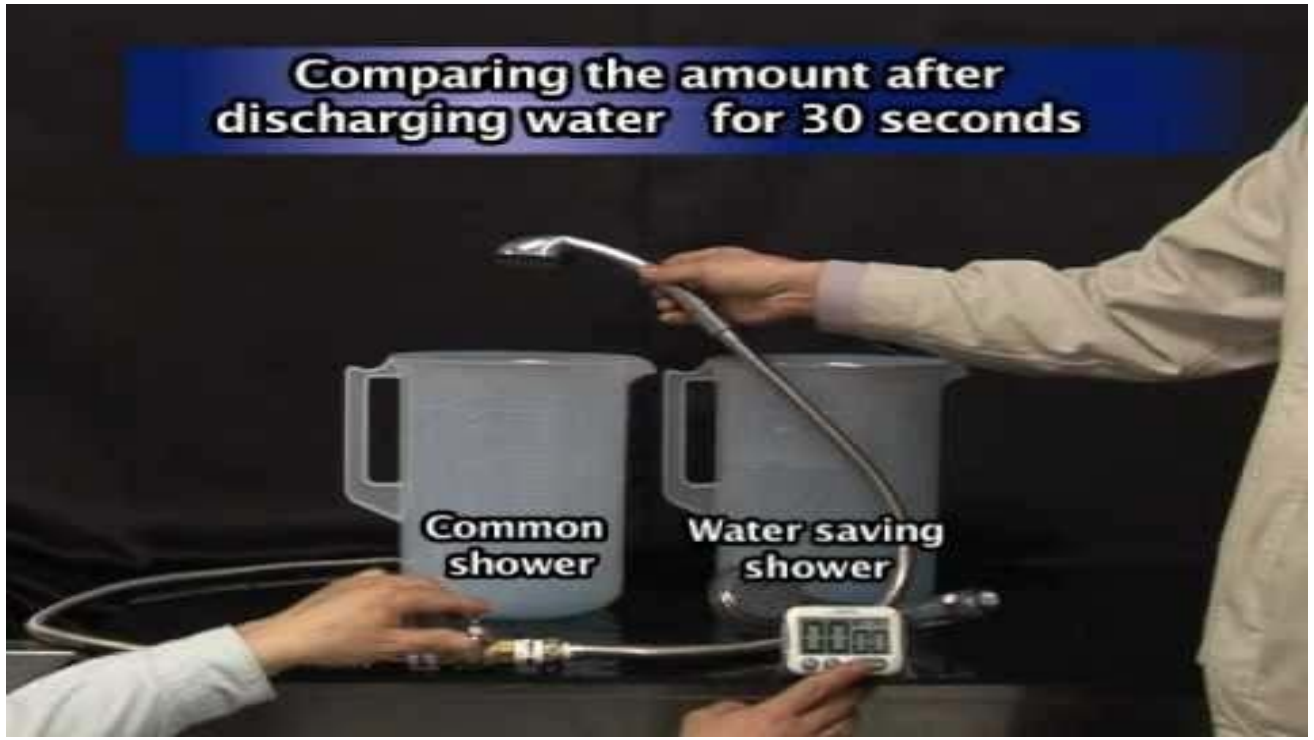
Design of investigation

Investigations on the effect of design of filters on the performance of a water-saving faucet:

Investigation	Independent Variable	Dependent Variable
1	Design of filter	Water flow
2	Design of filter	Water pressure

Extension: Water saving shower head

- How does it work?
- How can we test its water saving performance?



Extension: Water saving shower head

- Water flow + water pressure

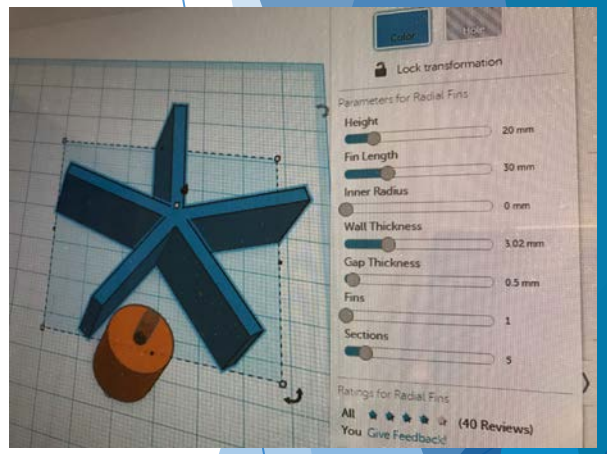
How to save water properly
Is total water usage really reduced?

15 minitus to wash body and hair	**30 minitues** to get things done because water pressure is too low to rinse off	**15 minitues** to get things done since the pressure is not reduced.
Normal shower head	Water saving shower head	E-Shower
		
20L / min	10L / min	10L / min
Total water usage	Total water usage	Total water usage
20L × 15 min = **300L**	10L × 30 min = **300L**	10L × 15 min = **150L**

We take shower with a purpose of washing and rinsing body and hair. How long does it take to get the things done propely ? **It all depends on water pressure. Water pressure always influence times required to get things done.** Of course, the longer time on showering , the larger water consumption. **Less water flow is likely to lower water pressure. But E-shower has been manufactured by water saving specilaists. We have know-how of keeping water pressure with less water flow. E-shower is the best choice fo you to save showering water.**

Preparation for investigation

We need the objects for testing and here is where 3D printing technology comes in place.



- Tailor-made
  - Dimension
  - Shape
  - Precision

Conducting the investigation

- Let's look at a video showing our trial of the investigation

- Pre-printed 3D models will be provided to each group so that you can preliminarily experience the effects of alterations on 3D models.