What is the Hypothesis–Experiment Class?

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Association for Studies in Hypothesis–Experiment Class

Recognition of a physical object or scientific truth is established only through experiment. Dr. Kiyonobu Itakura, 1966

This is the philosophy underlying Hypothesis–Experiment Class (HEC).

Goals of HEC

Goal 1: Make sure each and every pupil gains the ability to use the central theory or concept.

Goal 2: Structure the class so that most pupils report that they like both science and these science classes.

Goal 3: Make all necessary preparations so that any teacher sufficiently passionate about education, not just special veteran teachers, will be able to teach this type of class.

Hypothesis–Experiment Class Management

Before Class

0 HEC is an "introductory class in fun science."

The teacher should strive to create a relaxed and open atmosphere in the classroom such that each individual pupil can enjoy thinking. The heart of each Hypothesis–Experiment Class is a corresponding Classbook, composed specifically for pupils to independently acquire a certain concept or rule as a part of their own thinking by progressing through a series of problems.

In previewing the Classbook, you may find that you have already covered some of the material with your students. Regardless, please simply treat this material as a review and go through the material here. A Classbook for a single topic is usually divided into 2 or 3 portions. Make sure to complete entire portions of the Classbook. Do not simply pick and choose "interesting" problems from the various chapters.

0-1 Prepare all items necessary for the class.

Please check the Classbook to confirm necessary items, and gather the experiment equipment and tools for each problem, as well as any items the teacher will have to show the pupils.

0-2 Print out the parts of the Classbook that will be passed out to pupils.

Do not hand out the complete, bound Classbook all at once. Only hand out the one sheet necessary for the current problem. Pupils must not be allowed to prepare for Hypothesis–Experiment Classes. (This means that teachers should avoid inadvertently helping pupils prepare for the class.) So, the teacher must prepare individual printed copies of each page in the Classbook.

Please print and arrange them carefully, so that the original page order of the Classbook is maintained. If one side of the Classbook page is blank, you must not print the next page on that blank side.

The Classbook is arranged so as to prevent pupils from knowing about the results of the experiment before they have the chance to make guesses and discuss the problem. This ensures that pupils learn the fun of "coming up with an expectation, and then performing an experiment." The most important idea here is: Do not let information about the result of the experiment be printed on the same paper as the *Problem*.

0-3 Perform a preparatory experiment.

Try actually practicing the experiment to perform it in a way that pupils will definitely be able to see the proper result immediately.

Class Management

A Introduction

A-1 Hand out the sheet from the Classbook that corresponds to the problem.

Pupils may collect and store these sheets in a binder.

A-2 Read the Problem

Once all pupils have received the Classbook sheet, the *Problem* should be read. Either the teacher can read the problem, or the teacher can have a pupil read the problem.

The important thing for the *Problem* section is **making sure that all pupils understand the meaning of the problem.** The teacher may even demonstrate the experimental setup or actual thing (without giving away what the experiment result will be), saying "this is what the problem is asking." Making sure that each and every pupil has a good understanding of the problem and can come up with an expectation

will ensure that all pupils have an interest in how the experiment turns out.

The Classbook makes a distinction between "Questions" and "Problems." Questions simply inquire of pupils' prior experiences or other incidentals and should not receive too much focus.

A-3 Encourage Pupils to come up with an Expectation

Once the problem explanation is complete, each pupil should come up with their own expectation. The teacher may write down choices on the blackboard, and may even draw pictures or graphs to clarify the differences between the choices.

Each pupil should circle their choice in their Classbook. If any pupil is really having trouble coming up with a choice, the teacher should tell them that they can change their choice later and encourage them to simply choose anything.

B Tallying Choices and Reasons for Each Choice

B-1 Take Totals for Each Choice

Once the teacher confirms that all pupils have made a choice, the teacher should count up the number of people making each choice. Indicating each choice and having the pupils raise their hands is a good way to do this. After counting the total number of people for a given choice, the teacher should write that number on the chalkboard.

This allows the pupils to see the distribution of choices made by the class.
If the total does not match the number of pupils in class, the teacher can say "Hum, maybe I made a mistake" and re-count the votes. We want each pupil's expression of choice to be treated as important. However, there is no need to spend much time on the tallying section.

B-2 Pupils Offer Reasons

For each choice, the teacher should ask for any pupil who made that choice to offer a reason by asking "what was your reason for selecting this?" The key purpose for this is to make pupils aware of "what ideas or thoughts are opposing."

Many teachers find the most effective order to be the choices with fewer people first, followed by more popular choices. It may be hard for pupils who choose the less popular options to offer their reasons after they have heard the thoughts and reasons from the majority.

If no pupils want to offer a reason, the teacher may call on pupils by name. However, the teacher should still accept answers like "I dunno, I just guessed" even in that case. This is to protect pupils' right to freely offer their voices. If a lot of pupils want to offer additional reasons, the teacher should proceed only until the opposing ideas/viewpoints are made clear, and then conclude this section. The teacher can

encourage pupils who did not get a chance to state their reasons to wait and go early in the next stage, the discussion

C Let's Discuss!

Next is the discussion. The teacher should enter the discussion with something like "So, we've heard various reasons. Does anyone disagree or have any questions?"

The discussion should not be forced because some Problems will result in active discussions and other Problems simply will not. If no discussion results, simply proceed with class.

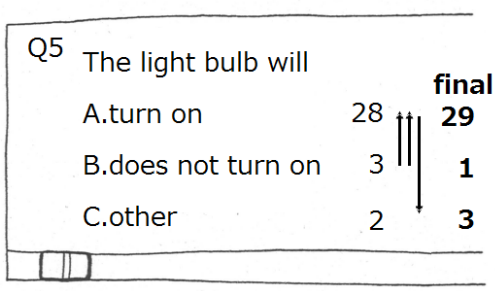
Conversely, if the main points of disagreement are clear but the discussion seems to be dragging on, the teacher should ask the pupils listening to the discussion "So, what should we do? Should we discuss a little more?" If the majority of pupils listening want to hear more, the teacher should allow for "one or two more comments" and then conclude the discussion. In this way, in Hypothesis–Experiment Classes, the option whether to discuss or not is left up to the pupils.

To make the opposing ideas clearer, the teacher may add minor comments, but the teacher must be very careful not to inadvertently support only the right choice.

D Changing One's Expectation before the Experiment

Once the discussion has ended, the teacher should ask if there are any pupils who changed their mind and want to alter their choice before entering the experiment stage. Pupils who want to change their Expectation should say "change mine from A to C" or something that expresses the original choice and their new choice.

If there is a change, the teacher should account for that by correcting the tallies on the chalkboard, as shown in the figure. The teacher should also ask what convinced the student to make the change.



E Performing the Experiment

E-1 The teacher performs the experiment.

The teacher should think about where to set up the experiment and where pupils should be so that all of them can clearly observe the experiment.

The Classbook for Hypothesis–Experiment Classes usually provides an explanation for performing the experiment that ensures that the result is clear. However, the teacher should clearly state the result of the experiment once it's finished, by saying "**A** was the result" so that pupils can see the relationship between their choices and the actual result.

However, the teacher must resist the urge to explain the result of the experiment. If any type of explanation is required, it is generally already provided in the Classbook in the proper place. Any other tempting interpretations must be examined in subsequent experiments to determine whether or not they are correct.

E-2 Record the Results of the Experiment

Once the results of the experiment are clear, the pupils should record the results in their Classbook.

E-3 Read Some Information

Between problems, there may be passages that explain the experiment result or define certain terms. These should usually be read by the teacher.

The teacher can add a further explanation if the pupils seem to require it. However, the teacher must make efforts to ensure that this does not give away answers to future problems or inhibit pupils' ability to think freely about those problems.

Cycle through A-E in accordance with the Classbook.

F Enrichment and Evaluation

F-1 Enrichment Problems

You will also find enrichment problems with some Classbooks. The enrichment problems are not required, but given enough time and pupil level, going through these problems can help pupils gain a deeper understanding of the material.

F-2 Pupils Write Down their Reflections and Feelings about the Class (Does not have to be after every hour of class.)

This is not strictly necessary, but many HEC teachers have found that getting pupils to write down their "feeling about the class that day" helps them see whether pupils are enjoying the class at that point in the Classbook.

Teachers might not grasp exactly what pupils are feeling about class merely through observation.

F-3 End-of-Book Evaluation

Once the class has progressed through every section of the Classbook, the teacher gives a test made up of problems taken from the Classbook.

Then, pupils should fill out an evaluation of the class, writing down any comments or feelings they have about it.

We have created evaluation forms with the following two sections:

・Section for writing comments and feelings about the class.

・Section for rating the class on a scale 1-5 in response to the prompt "How did you find the lesson?"

The 5-rank scale is:

5 – It was very enjoyable.
4 – It was enjoyable.
3 – No strong opinion either way.
2 – It was boring.
1 – It was very boring.

For any classes taught with a well-polished Classbook, most kids will get high scores on the test and be pleased with their experience.

We consider the Hypothesis–Experiment Class a success if most of the pupils rate the class a 4 or 5. Even teachers new to the Hypothesis–Experiment Class will generally produce a highly rated class.

The pupils' evaluations and comments have helped us delve into research on ways to improve the Classbook by allowing us to compare across different schools and classrooms.

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Association for Studies in Hypothesis–Experiment Class

Dr. Itakura, along with early supporters and practitioners, organized the Kasetsu-Jikken-Jugyo Kenkyu-kai (Association for Studies in Hypothesis–Experiment Class, or ASHEC) in order to make Hypothesis–Experiment Class a reality. As of 2016, there are over 1200 members from all across Japan.

The association members create, revise and propagate Classbooks and related teaching materials, as well as hosting training sessions, talks, and seminars for beginners, both in local areas and nationally. All activities are voluntarily proposed by individual members, and then organized into an executive committee or other operations group. Dr. Itakura had been the spokesperson for ASHEC until just before his death. Currently Saburo Takeuchi is acting as the ASHEC spokesperson.

The following URL is for the association's portal site, maintained on a volunteer basis by the members. There are also English pages available. ***http://www.kasetsu.org***

Main Classbooks

Initially, most of the Hypothesis–Experiment Classbooks were written for the physical sciences. However, in the 50 years since its inception, a wide variety of other fields have come to be treated in Classbooks as well. Currently, there have been over 200 Classbooks and drafts (Classbooks which are still undergoing revision) created, and they are being continually put into practice and reviewed.

Many of the Classbooks are accompanied by explanatory manuals, created by research members with significant practical experience with the Classbook, regarding classroom management and experiment procedures.

Natural Sciences

Springs & Force, *Pendulums & Oscillation*, *Air & Water*, *Objects & their Weight*, *If You Could See Atoms*, *Pulleys & Amount of Work*, *Light & Magnifying Glasses*, *Magnets*, *Batteries & Circuits*, *Dissolving*, *Rainbows & Light*, *Let's Play with Dry Ice*, *Temperature & Molecular Motion*, *The Three Phases of Matter*, *Electric Current*, *Crystals*, *When You Find Free Electrons*, , *Let's Play with Generator*, *Polarized Light, Torque & Center-of-Gravity*, *Buoyancy & Density*, *Force & Motion*, *The Road to Space*, *Moon & Sun & Earth*, *Limestone – A Mysterious Rock*, *Combustion*, *Flowers & Seed*, *Animals with Backbones*, *How Many Legs?, Seeds & Sprouting*, *Food & Ions*, *Living Things & Cells*, *Living Things & Species,*

Mathematics

The World of Doubling & Tripling, *Space & Area*, *The World of Free-Fall Motion*, *Figures & Angles, Real Numbers & Fake Numbers*, *One & Zero,*

Social Sciences

Introduction to Japanese History, *Countries of the World, World Flags, and so on.*

☆ **Available in English** (Several other Classbooks are also currently being translated.)
Objects & their Weight, *If You Could See Atoms*, *Air & Water*, *Let's Play with Dry Ice*, *Force & Motion (Part-1)*, *How Many Legs?*, *and The Surface of Water*

Currently, most Classbooks and related books are published by Kasetu-sha (Sugamo, Tokyo. *http://www.kasetu.co.jp*). Contact: *mail@kasetu.co.jp*

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‘HYPOTHESIS-EXPERIMENT CLASS (*Kasetsu*)’

With Practical Materials for Fun and Innovative Science Classes

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The first English edition of the collected papers of Dr. Itakura, HEC advocate

Hypothesis–Experiment Class (HEC) or "Kasetsu", enables pupils to engage with science concepts using unique teaching materials called “Jugyosho”, the HEC Classbook. HEC and its Classbook were proposed by Dr. Itakura in 1963 based on his theory that recognition of physical phenomena or scientific truth is established only through experiment.

Attractive Classbooks in various fields have been developed and utilized at all levels from primary education to university liberal arts courses. Almost all pupils and students exposed to HEC find the classes fun, regardless of when, where, and by whom it is carried out.

Main Content

Collection of Articles and Essays

Appendices

H-E Classbooks