# Samarbeidslæring

Samarbeidslæring omtales som cooperative learning (CL) på engelsk og forklares som læring av fag ved hjelp av samarbeid. I samarbeidslæring arbeider elevene sammen i grupper etter bestemte prinsipper. Metoden er tydelig lærerstyrt og skiller seg slik fra andre former for gruppearbeid. I samarbeidslæring er læreren en tydelig arbeidsleder som utformer arbeidsoppgaver knyttet til det faglige innholdet og etablerer støttestrukturer rundt elevenes samhandling. Strukturene, eller reglene sørger for at alle i gruppen er aktivt involvert i eget og andres læringsarbeid.

- Exploring the Everyday Context of Chemical Elements: Discovering the Elements of Car Components
- Stepwise Inquiry into Hard Water in a High School Chemistry Laboratory
- Chemical Alias: An Engaging Way To Examine Nomenclature
- Orbital Battleship: A Guessing Game to Reinforce Atomic Structure
- Nature or Naughty: Bringing “Deflategate” to the High School Chemistry Classroom
- Chemistry Cube Game – Exploring Basic Principles of Chemistry by Turning Cubes
- Jigsaw: Using Cooperative Learning in Teaching Organic Functions
- Do-It-Yourself: Creating and Implementing a Periodic Table of the Elements Chemical Escape Room

# Exploring the Everyday Context of Chemical Elements: Discovering the Elements of Car Components

**Author**: Antonio Joaquín Franco-Mariscal

**Year**: 2015

## Abstract

This paper presents a project about the chemical elements made by 15-year-old Spanish high school students of Chemistry. It focuses on contex-based teaching combined with the advantages of creating a large mural which subsequently is exposed in the school. The project consisted of researching the chemical elements in the different materials that make up a car, identifying the uses of some chemical elements in daily life, and remembering the names and symbols of the elements. Students' response to the activity was evaluated through a survey in which progress can be seen in the pupils' knowledge regarding the names, symbols, and uses of the chemical elements in daily life. An additional attitudes' survey showed that students had enjoyed the project and the task had helped them understand how chemical elements are used to create materials.

**Keywords**: First-Year Undergraduate/General, High School/Introductory Chemistry, Physical Chemistry, Collaborative/Cooperative Learning, Humor/Puzzles/Games, Inquiry-Based/Discovery Learning, Applications of Chemistry, Student-Centered Learning, Periodicity/Periodic Table

**Referanse:** Franco-Mariscal, A. J. (2015). Exploring the Everyday Context of Chemical Elements: Discovering the Elements of Car Components. *Journal of Chemical Education*, *92*(10), 1672-1677.

https://doi.org/10.1021/acs.jchemed.5b00164

**Tag**: kjemi, samarbeidslæring

# Stepwise Inquiry into Hard Water in a High School Chemistry Laboratory

**Author**: Mami Kakisako, Kazuyuki Nishikawa, Masayoshi Nakano, Kana S. Harada, Tomoyuki Tatsuoka, and Nobuyoshi Koga

**Year**: 2016

## Abstract

This study focuses on the design of a learning program to introduce complexometric titration as a method for determining water hardness in a high school chemistry laboratory. Students are introduced to the different properties and reactions of hard water in a stepwise manner so that they gain the necessary chemical knowledge and conceptual understanding of the basic principles of complexometric titration. This approach involves investigating the performance of soap and household laundry detergent in hard water and using a colorimetric method to semiquantitatively determine the concentration of calcium ions in hard water by a test kit. The stepwise inquiry and learning are promoted using coordinated experimental work, logical thinking, and discussion with the aid of demonstrations and explanations. As each inquiry and learning step is completed, students develop models that describe the observed chemical properties and reactions of hard water. Using the simple models that they develop, students finally propose the basic principles of complexometric titration for determining water hardness. Based on their experimental principles, practical titration experiments are performed and the experimental data are analyzed to determine water hardness. Throughout the learning program, students actively apply preliminary knowledge and acquire new chemical knowledge and conceptual understanding from the laboratory exercises. Therefore, the students experience the process of scientific inquiry accompanied by the development of their understanding of chemical concepts. This paper reports that the developed learning program may be introduced as a suitable laboratory learning exercise in high school chemistry courses.

**Keywords**: High School/Introductory Chemistry, Analytical Chemistry, Environmental Chemistry, Collaborative/Cooperative Learning, Inquiry-Based/Discovery Learning, Aqueous Solution Chemistry, Water/Water Chemistry

**Referanse:** Kakisako, M., Nishikawa, K., Nakano, M., Harada, K. S., Tatsuoka, T., & Koga, N. (2016). Stepwise inquiry into hard water in a high school chemistry laboratory. *Journal of Chemical Education*, *93*(11), 1923-1928.

https://doi.org/10.1021/acs.jchemed.6b00217

**Tag**: kjemi, utforskende arbeidsmåter, samarbeidslæring

# Chemical Alias: An Engaging Way To Examine Nomenclature

**Author**: Mikhail Kurushkin and Maria Mikhaylenko

**Year**: 2015

## Abstract

An educational card game, “Chemical Alias”, has been developed as an alternative method of reviewing students’ knowledge of nomenclature. In contrast to conventional tests, this highly competitive activity is a fun and effective way to examine and reinforce nomenclature. The students play in pairs, using Clark’s famous spiral arrangement of the elements as the board and cards with chemical formulas. One of the students names the chemical compounds and the other answers with their chemical formulas. The counters are moved through the elements according to the number of correct answers.

**Keywords**: High School/Introductory Chemistry, First-Year Undergraduate/General, Inorganic Chemistry, Collaborative/Cooperative Learning, Humor/Puzzles/Games, Nomenclature/Units/Symbols

**Referanse:** Kakisako, M., Nishikawa, K., Nakano, M., Harada, K. S., Tatsuoka, T., & Koga, N. (2016). Stepwise inquiry into hard water in a high school chemistry laboratory. *Journal of Chemical Education*, *93*(11), 1923-1928. https://doi.org/10.1021/acs.jchemed.6b00217

**Tag**: kjemi, samarbeidslæring

# Orbital Battleship: A Guessing Game to Reinforce Atomic Structure

**Author:** Mikhail Kurushkin and Maria Mikhaylenko

**Year**: 2016

## Abstract

A competitive educational guessing game “Orbital Battleship” which reinforces Madelung’s and Hund’s rules, values of quantum numbers, and understanding of periodicity was designed. The game develops strategic thinking, is not time-consuming, requires minimal preparation and supervision, and is an efficient and fun alternative to more traditional forms of education.

**Keywords**: High School, Introductory Chemistry, First-Year Undergraduate, General, Physical Chemistry, Collaborative, Cooperative Learning, Humor, Puzzles, Games, Atomic Properties/Structure

**Referanse:** Kurushkin, M., & Mikhaylenko, M. (2016). Orbital Battleship: A guessing game to reinforce atomic structure. *Journal of chemical education*, *93*(9), 1595-1598.

https://doi.org/10.1021/acs.jchemed.6b00136

**Tag**: kjemi, samarbeidslæring

# Nature or Naughty: Bringing “Deflategate” to the High School Chemistry Classroom

**Author**: Elizabeth J. Megonigal

**Year**: 2016

## Abstract

In this activity, students work in groups, delving into a real-life sports melodrama - “Deflategate”. Using their knowledge of the behavior of gases, and data collected by an independent investigative team, students draw evidence-based conclusions to the question: “Could the underinflated footballs used by the New England Patriots have been caused by environmental conditions during the game?” As this engaging and thought-provo king activity unfolds, students employ many of the science practices outlined in the National Research Council’s A Framework for K−12 Science Education.

**Key words**: High School/Introductory Chemistry, Curriculum, Collaborative/Cooperative Learning, Communication/Writing, Gases

**Referanse:** Megonigal, E. J. (2016). Nature or naughty: Bringing “Deflategate” to the high school chemistry classroom. *Journal of Chemical Education*, *93*(2), 311-313.

https://doi.org/10.1021/acs.jchemed.5b00617

**Tag**: kjemi, samarbeidslæring

# Chemistry Cube Game – Exploring Basic Principles of Chemistry by Turning Cubes

**Author**: Markus T. Müller*

**Year**: 2018

## Abstract

The Chemistry Cube Game invites students at secondary school level 1 and 2 to explore basic concepts of chemistry in a playful way, either as individuals or in teams. It consists of 15 different cubes, 9 cubes for different acids, their corresponding bases and precursors, and 6 cubes for different reducing and oxidising agents. The cubes can be rotated in those directions indicated. Each ‘allowed’ vertical or horizontal rotation of 90° stands for a chemical reaction or a physical transition. Two different games and playing modes are presented here: First, redox chemistry is introduced for the formation of salts from elementary metals and non-metals. Second, the speciation of acids and bases at different pH-values is shown. The cubes can be also used for games about environmental chemistry such as the carbon and sulphur cycle, covering the topic of acid rain, or the nitrogen cycle including ammoniac synthesis, nitrification and de-nitrification.

**Key words**: Acids/bases · Basic chemical principles · Chemistry Cube Game · Collaborative/cooperative learning · Equilibrium · Inquiry-based/discovery learning · Humor/puzzles/games · Oxidation/reduction · Salt formation · Secondary school level 1 and 2 · Speciation

**Referanse:** Müller, M. T. (2018). Chemistry Cube Game–Exploring Basic Principles of Chemistry by Turning Cubes. *Chimia*, *72*(1-2), 62-62.https://doi.org/10.2533/chimia.2018.62

**Tag**: kjemi, samarbeidslæring, utforskende arbeidsmåter

# Jigsaw: Using Cooperative Learning in Teaching Organic Functions

**Author**: Brenno R. M. Oliveira, André L. Vailati, Edinara Luiz, Fabrine G. Böll, and Samuel R. Mendes

**Year**: 2019

## Abstract

This study discusses the potential of the Jigsaw cooperative method in the teaching of organic chemistry. Such an approach was used in five classes with Brazilian secondary school students. Results indicate better learning regarding the development of knowledge about the nomenclature, application, and identification of functional groups at the beginning and at the end of cooperative work classes. Therefore, the Jigsaw method is an important didactic strategy to potentialize the learning of chemistry.

**Key words**: General Public, Chemistry Education Research, Organic Chemistry, Collaborative/Cooperative Learning

**Referanse:** Oliveira, B. R., Vailati, A. L., Luiz, E., Boll, F. G., & Mendes, S. R. (2019). Jigsaw: using cooperative learning in teaching organic functions. *Journal of Chemical Education*, *96*(7), 1515-1518. https://doi.org/10.1021/acs.jchemed.8b00765

**Tag**: kjemi, samarbeidslæring, puslespillmetoden

# Do-It-Yourself: Creating and Implementing a Periodic Table of the Elements Chemical Escape Room

**Author**: Malka Yayon, Shelley Rap, Vered Adler, Inbar Haimovich, Hagit Levy, and Ron Blonder

**Year**: 2020

## Abstract

This year (2019) represents the 150th year since the discovery of the periodic table of the elements (PTOE). In honor of this important event, we designed a PTOE chemical escape room (called ChEsRm) that is suitable for middle and high school chemistry students. The main idea behind this ChEsRm is that it is relatively easy and inexpensive for teachers to build in order to introduce the activity into as many chemistry classrooms as possible. The puzzles of ChEsRm include interesting facts regarding the elements, their every day use, and their properties, as well as the subatomic particles. Some involve actual experiments and other nonlaboratory activities. Participants are asked to solve a mystery: finding the cause of a mysterious death. Although most escape rooms use locks and keys, in this case the mechanism used to reveal the solution is different and more flexible. Here we provide a detailed description of all the puzzles and explain how to operate the escape room in a school lab.

**Key words**: Collaborative/Cooperative Learning, Hands-On Learning/Manipulatives, Humor/Puzzles/Games, Problem Solving/Decision Making, Inquiry-Based/Discovery Learning, Student-Centered Learning, Periodicity/Periodic Table, Elementary/Middle School Science, High School/Introductory Chemistry

**Referanse:** Yayon, M., Rap, S., Adler, V., Haimovich, I., Levy, H., & Blonder, R. (2019). Do-It-Yourself: Creating and Implementing a Periodic Table of the Elements Chemical Escape Room.

*Journal of Chemical Education*, *97*(1), 132-136. https://doi.org/10.1021/acs.jchemed.9b00660

**Tag**: kjemi, samarbeidslæring