EDUCATING SCIENCE TEACHERS FOR ALL
- ESTA -

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ESTA
Educating Science Teachers for All

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BACKGROUND OF THE PROJECT

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- EU-report on science education for responsible citizenship and the Paris declaration recommend *teaching all students for our better future*
- in Georgia, the Philippines, and Bosnia and Herzegovina, a large number of young people do not meet basic requirements in science.
- in international assessments of science performance in which all three countries scored very low.

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WHAT WE HAVE IN COMMON?

- one great challenge for science education in Georgia, Bosnia and Herzegovina, and the Philippines are the countries' plurality of languages and cultures.
- while the education system in Georgia, and Bosnia and Herzegovina, underwent major changes after the fall of the Soviet Union and the subsequent conflicts in power relations, colonialism has left its imprint on the Philippine educational system.
- science education in all three countries takes place amidst political and ethnic differences divides that translate into linguistic heterogeneity and cultural diversity.

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GEORGIA

- Georgia was severely affected by the great changes after the dissolution of the Soviet Union and several armed conflicts took place in the country.

  => A central goal for the Georgian government was to become an independent state.

- Georgian as the official language in order to free the people from the former linguistic and cultural repression.
- existing multitude of local languages as well as the country's cultural diversity (86,8 % Georgians, 6,3 % Azeris, 4,5 % Armenians and a considerable number of smaller ethnic groups)
- not only is Georgian spoken but also Azerbaijani, Armenian, Russian and other languages.
- ethnic and political conflicts
- in rural areas schools don't receive the same resources as urban schools

https://magazin.sofatutor.com/lehrer/deutschunterricht-in-georgien-lehrerin-berichtet/

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BOSNIA AND HERZEGOVINA

- education has been used as an instrument for fostering nationalist tendencies after the fall of the Soviet Union and the Bosnian war.
- several educational systems exist alongside each other
  - Bosniac Muslims, Serbian Orthodox Christians, and Croat Catholics living in the same country learn different interpretations of historical events, have a different religious education, and are taught in different languages, which they speak now as well.

=> It leads to exclusive and discriminatory practices in Bosnian schools, in particular concerning ethnic minorities such as Roma children.

https://www.kosmo.at/new-york-times-schulkinder-in-bosnien-getrennt-durch-einen-metallzaun/

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THE PHILIPPINES

- linguistic heterogeneity is a central issue as a reflection of the cultural diversity present in the Philippines with its more than 110 indigenous groups.
- more than 170 languages are spoken as first languages due to the multitude of regional dialects and languages.
- only two of these – English and Filipino – are officially recognized.
- on 2009, the Philippines changed their language policy. Since then, schools are supposed to use regional languages as languages of instruction. However, this is true only for the first three years of primary school after which the education again takes place in English and Filipino, and only 19 languages were selected as languages of instruction.
- most students still learn science in a foreign language, mostly in English.

https://www.planet-schule.de/wissenspool/philippinen-reis-fuer-die-zukunft/inhalt/hintergrund.html

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CHALLENGES LIE ...

(1) in the super-diversity of languages, and

(2) the political and religious divides (especially present in Bosnia and Herzegovina, and Georgia).

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WHAT IS NEEDED?

- pre- and in-service science teachers who can deal with cultural and linguistic diversity in their science classes
- teaching and learning materials which are (i) language sensitive, (ii) language supportive and (iii) cultural sensitive in their nature

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WHO IS TAKING THE CHALLENGE?

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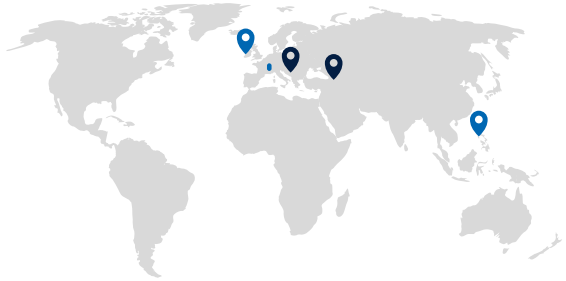

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TARGET GROUPS

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- the main target group for all partner institutions from the partner countries is the ***university science teacher educators***.
- topics such as inclusion, diversity, inclusive and sensitive science teaching
- support in their development as teaching professionals especially focusing on the named issues.
- facing linguistic and cultural diversity in their seminars at university as well
  - *practice what you preach*

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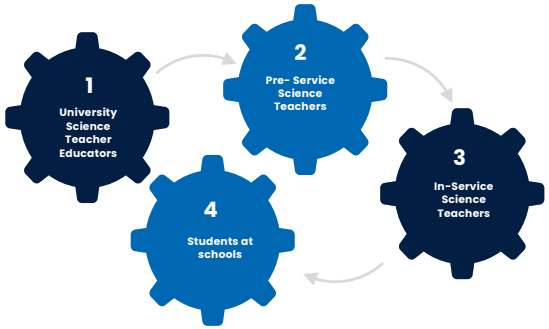

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REACHING OUR GOAL

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WIDER OBJECTIVES

- improving the level of competencies in HEI in partner countries by professionalization and development of university science teacher educators regarding diversity in science classes (focus on language and culture).
- teacher educators, in turn, will share their knowledge and skills with in-service and pre-service science teachers, and thereby contribute to a more inclusive and higher quality science teaching.

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SPECIFIC OBJECTIVE

ESTA seeks to contribute to more responsible science education in this regard through

i. the inclusion of cultural diversity and linguistic heterogeneity issues in science teacher education, through

ii. developing university curricula and courses for educating future teachers for diversity sensitive science teaching, by

iii. developing the university curricula and courses following the model of CLIL and Action Research and focusing on interdisciplinary work between the departments of physical sciences, languages, general education, and/or cultural studies, furthermore

iv. subsequent adaptation of these curricula and courses to the respective local contexts and their unique patterns of diversity,

v. providing Continuous Professional Development to in-service science teachers about diversity sensitive science teaching, and

vi. promoting virtual mobility and the use of open educational resources in order to make available to everyone the ideas of diversity sensitive science teaching.

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HOW?

Building a transnational network of university science teacher educators in which evidence for the effectiveness of new approaches to science teaching and learning will be shared and discussed in order to implement only the most effective and efficient measures.

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Our Strategy

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01 professionalization of university staff from the partner countries through a visit of researchers from Germany and Ireland in the partner countries (Academic Staff Tour). Methods and materials that have proven effective in dealing with diversity in the Western European context will be shared.

02 adaptation and further development of the methods, tools, and material for pre- and in-service teacher training, to the local contexts of diversity. This will be done using the model of CLIL and Action Research.

03 development and implementation of teaching and learning resources for diverse science classes in the partner countries (Georgia, Bosnia and Herzegovina, the Philippines).

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PROJECT ACTIVITIES AND METHODOLOGY

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Academic Staff Tour

01

- Professionalization of university staff from partner countries by visiting program countries
- Supervision of partner countries by the program countries
- Networking by visiting and exchanging about success and challenges

Interdisciplinarity and international exchange

02

- Involvement of experts from different background
- Implementation and evaluation of the courses

Action Research

03

- Cyclical process of material development

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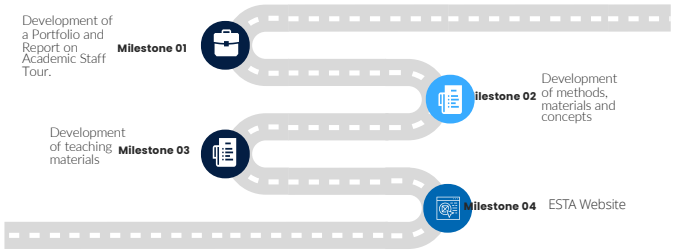
MILESTONES and INDICATORS



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RESULTS EXPECTED

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Science teachers prepared for diversity

Teachers with knowledge about diversity in science teaching and skills for dealing with diversity in their science classes in order to make it more inclusive.

Open educational resources

Publishing material on the project website and/or in science education journals (both national and international).

1 2 3 4 5

New / Upgrades courses

At least one course will be developed and integrated into the curriculum for pre-service teachers in at least one science subject (documented structure and teaching materials (digital and analogous)

at least one concept for a workshop for in-service teachers will be developed in each university.

Teaching and learning materials for diverse science classes

teaching resources for diversity and language sensitive science teaching in secondary school will be developed

Internationalization

Professionalization via international network

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DIVERSITY

Race

Migration Background

Social Background

Culture (religion, tradition, behaviour)

Cognitive Skills

Personal (special) Needs

Language

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RATIONALS OF THE PROJECT

Developing lesson plans that …

- seek out teaching methods and learning materials for linguistically heterogeneous classes
- develop linguistic base for scientific language
- avoid a learning of wrong scientific language
- support of communication between students among each other
- integrate both content and language (CLIL)
- integrated learning (CLIL) with cooperative and autonomous learning

We want to …

- research the effects of lesson plans on teaching and learning

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To what extent it is possible to simultaneously learn scientific methods, terminology, content matter and the German language, while students work in a cooperative, autonomous learning environment?

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METHODS

- Participatory Action Research (Eilks & Ralle, 2002)
- focus on beginning lower secondary school lessons on various topics, e.g. matter and its properties
- Multidimentional triangulation:
  - after each lesson self-reflection by the teachers
  - classroom observation by the researcher
  - knowledge test and a student feedback tool (combination of an open and a Likert-type questionnaire)

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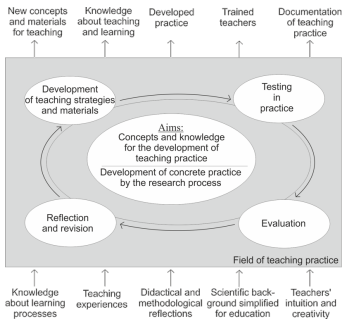

Eilks und Ralle (2002)

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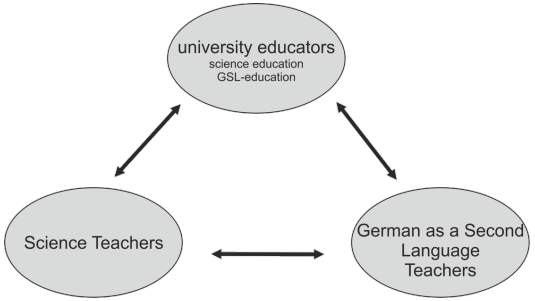
METHODS



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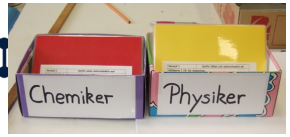
LESSON PLAN
„MATTER AND ITS PROPERTIES“



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Phase	Method
Phase 1 Experimenting	• two groups: chemists and physicists • experiments about the matter properties (chemical and physical) • working on research folder • Working on Stations
Phase 2 Exchanging	• groups: 2 chemists and 2 physicists • exchanging and working on exercise book

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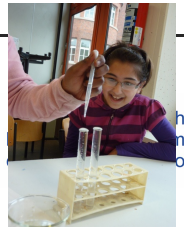
LESSON PLAN
„WATER“



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Phase	Method
Phase 1 Experimenting	• experiments about the water and its properties • working on research folder • Working on Stations
Phase 2 Exchanging	• Group work (think-pair-shair) • exchanging and working on exercise book

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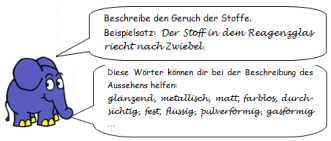
- Simple phrasing (1-sentance-constructions)
- List of Vocabulary (with article, plural)
- Words for helping to write the observation and discussion
- Beginning of the sentence
- Connecting the parts of the sentences
- Sentences of example
- Drawings as explanation
- Cloze



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EVALUATION

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- Student feedback (2 open, 15 Likert-type items)
- Knowlegde test

	Matter (N=119)	Water (N= 93)
Female	72 (60,5%)	35 (38%)
Male	47 (39,5%)	58 (62%)
With Migration Background	67 (56,8%)	63 (67%)
German not spoken at home	45 (37,8%)	56 (60%)

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KNOWLEDGE TEST

- was pre-structured by the teachers
- the majority passed the test successfully
- a high percentage of all student groups had scores of "good" or "very good“
- 84% of the participants achieved more than 80% of the total points possible

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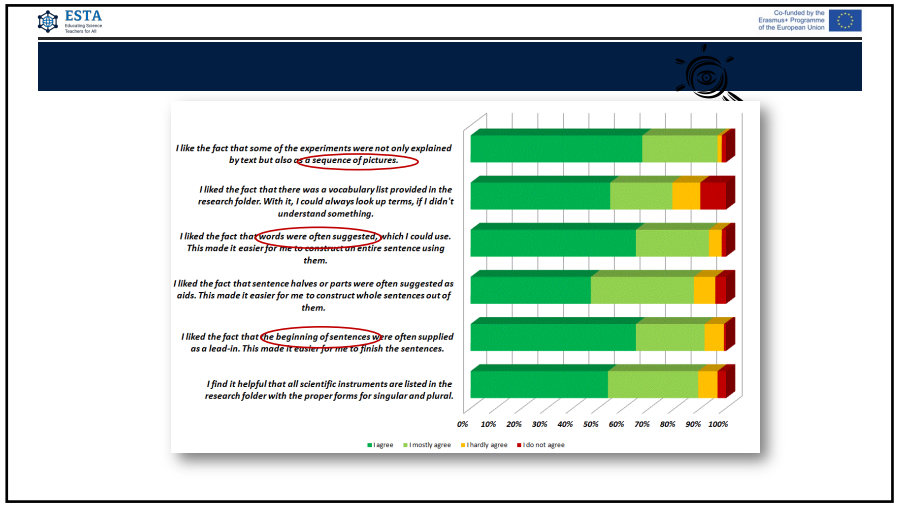
ESTA
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I like the fact that some of the experiments were not only explained by text but also as a sequence of pictures.
I liked the fact that there was a vocabulary list provided in the research folder. With it, I could always look up terms, if I didn't understand something.
I liked the fact that words were often suggested, which I could use. This made it easier for me to construct an entire sentence using them.
I liked the fact that sentence halves or parts were often suggested as aids. This made it easier for me to construct whole sentences out of them.
I liked the fact that the beginning of sentences were often supplied as a lead-in. This made it easier for me to finish the sentences.
I find it helpful that all scientific instruments are listed in the research folder with the proper forms for singular and plural.
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
I agree
I mostly agree
I hardly agree
I do not agree

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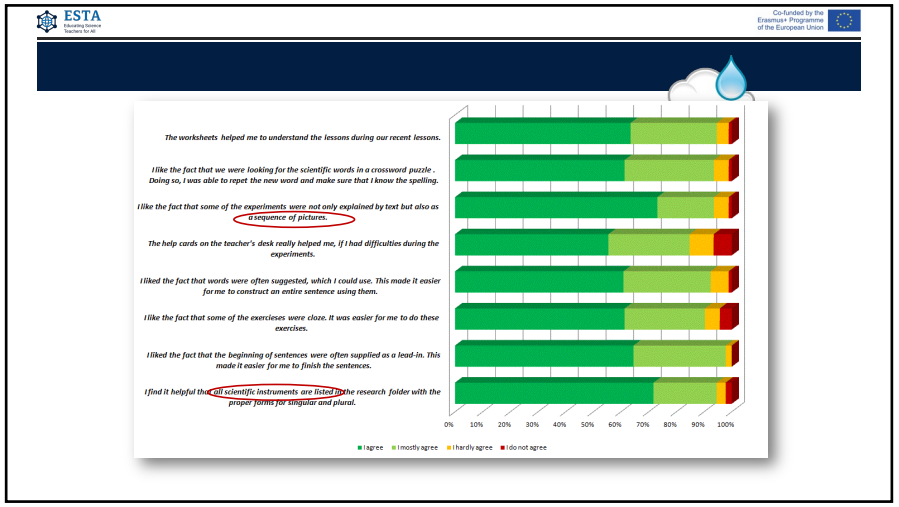
ESTA
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The worksheets helped me to understand the lessons during our recent lessons.
I like the fact that we were looking for the scientific words in a crossword puzzle . Doing so, I was able to repet the new word and make sure that I know the spelling.
I like the fact that some of the experiments were not only explained by text but also as a sequence of pictures.
The help cards on the teacher's desk really helped me, if I had difficulties during the experiments.
I liked the fact that words were often suggested, which I could use. This made it easier for me to construct an entire sentence using them.
I like the fact that some of the exercieses were cloze. It was easier for me to do these exercises.
I liked the fact that the beginning of sentences were often supplied as a lead-in. This made it easier for me to finish the sentences.
I find it helpful that all scientific instruments are listed in the research folder with the proper forms for singular and plural.
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
I agree
I mostly agree
I hardly agree
I do not agree

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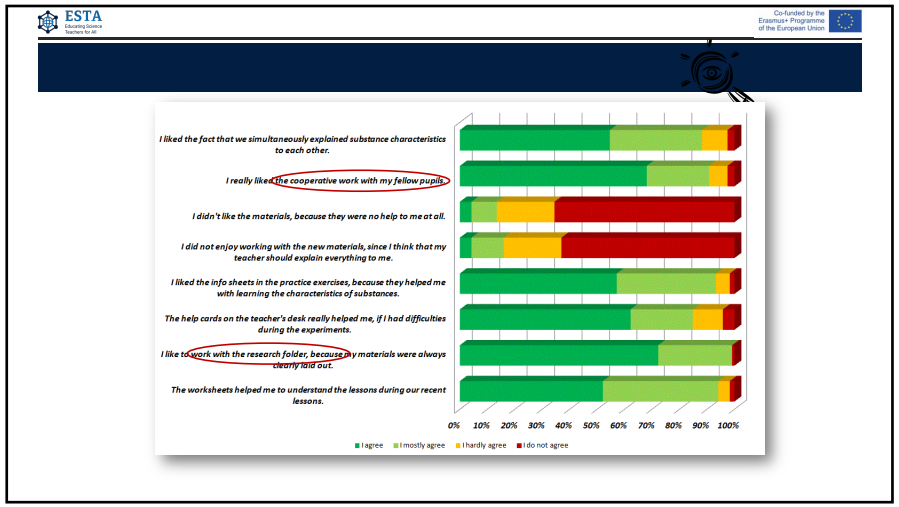
ESTA
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I liked the fact that we simultaneously explained substance characteristics to each other.
I really liked the cooperative work with my fellow pupils.
I didn't like the materials, because they were no help to me at all.
I did not enjoy working with the new materials, since I think that my teacher should explain everything to me.
I liked the info sheets in the practice exercises, because they helped me with learning the characteristics of substances.
The help cards on the teacher's desk really helped me, if I had difficulties during the experiments.
I like to work with the research folder, because my materials were always clearly laid out.
The worksheets helped me to understand the lessons during our recent lessons.
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
I agree
I mostly agree
I hardly agree
I do not agree

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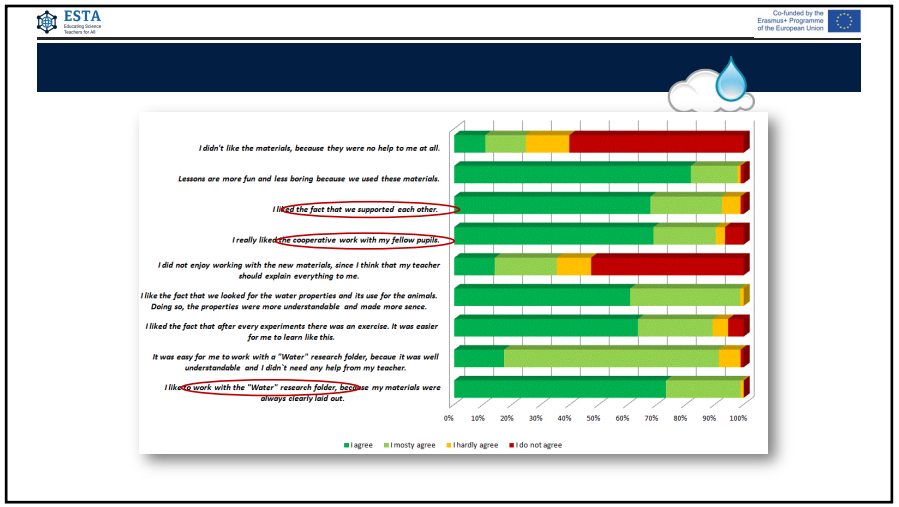
ESTA
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I didn't like the materials, because they were no help to me at all.
Lessons are more fun and less boring because we used these materials.
I liked the fact that we supported each other.
I really liked the cooperative work with my fellow pupils.
I did not enjoy working with the new materials, since I think that my teacher should explain everything to me.
I like the fact that we looked for the water properties and its use for the animals. Doing so, the properties were more understandable and made more sence.
I liked the fact that after every experiments there was an exercise. It was easier for me to learn like this.
It was easy for me to work with a "Water" research folder, becaue it was well understandable and I didn't need any help from my teacher.
I like to work with the "Water" research folder, because my materials were always clearly laid out.
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
I agree
I mostly agree
I hardly agree
I do not agree

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- Although the knowledge test is limited in judging long term effects, the short term results provide a good base from which to help the students to understand the topic autonomous, to express themselves much easier and correct in German language.
- The data seems to be promising and motivating to implement more approaches that focus on learning of scientific knowledge and German language and cooperative learning methods.

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The cooperation between chemistry/science teachers and German Second Language teachers …

- ✓ is a good possibility to develop new teaching materials concerning the linguistic heterogeneity of chemistry/science lessons.
- ✓ seems to be a promising way to create motivating and attractive learning environments that allow science teaching to help students not only to learn chemistry but also to improve their knowledge and competencies in German language.

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