FINAL INTERNATIONAL CONFERENCE

Remote Inquiry in Science Education

Part III: TEACHERS' POSTERS

27. – 28. JUNE 2023

Organised by
UNIVERSITY OF LJUBLJANA
FACULTY OF EDUCATION
SLOVENIA

2020-1-SI01-KA226-SCH-093576

Dear participants of RISE conference

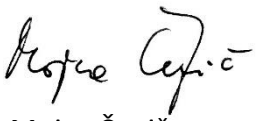
As many teachers presented their inquiries, we were forced to organize the presentations in parallel sessions. This simply means that not everybody was able to attend all the lectures that were interesting to her/him. Therefore, we strongly encouraged the presenters to prepare the poster as well.

The third e-book called “Teachers’ posters” and includes all posters from the Final conference of the Erasmus+ project Remote Inquiry in Science Education or shortly RISE. Posters were displayed throughout the whole conference. However, the collection of posters is larger than the collection of presentations. For the sake of completeness, we included all posters that were displayed during the conference. Some of them presented the work that was presented as lectures during the STAMPEd conference. The STAMPEd conference was organized for a day and a half from 26th to 27th of June. Organization in a sequence was intentional for saving the costs and allowing more teachers to share and meet during both events.

The posters in PowerPoint were transformed to PDF of the A4 page size. Posters are ordered by authors in alphabetic order.

The collection in a PDF form was compressed as much as possible, but the file is still big, so it may take some time for downloading.

We sincerely hope you will find useful and interesting information in this collection of posters.



Mojca Čepič
Coordinator of RISE and Chair of RISE conference

Ljubljana, 28th of July 2023


High school
Looking for the answer
21

POSTERS

How does the use of own notes during tests students' performance in physics?

Anna Bekas
Primary School No.62 im. kmdra. por. F. Dąbrowskiego in Krakow, Poland

How collaboration between students during physics lessons affects teaching results

Agnieszka Bożek
VIII Liceum Ogólnokształcące im. Stanisława Wyspiańskiego, Kraków, Poland

Let`s play

Mojca Buršič
Primary school Vojnik, Slovenia

Can the Use of a Refutation Text Increase Students' Understanding Earth and Space Science?

Alan Casey
Scoil Chonglais, Baltinglass, Ireland

The use of visual strategies with student-generated questions on student understanding in Speed/Distance/Time and Trigonometry

Peter Cummins
Edmund Rice College Dublin, Ireland

Asking questions as a crucial part of the scientific method within secondary education

Laura De Keyser
Arteveldehogeschool Gent, Belgium

Getting started with Inquiry – learning to develop hypotheses and plan experiments through common everyday tasks

Kristian Dimitrov
St.David's C.B.S, Dublin, Ireland

Connecting Physics with Mathematics through Experiential Learning

Stephen Gammell
School of physical Sciences, CDU, Ireland

Movement with IT

Špela Gec Rožman
Piran Gymnasium, Electrical and Maritime School, Piran, Slovenia

Supporting students to develop hypotheses and plan investigations through the context of learning about factors required for chemical reactions

Gerard Hughes
Ballymakenny College, Ireland

Physics Phenomena – Connection of Theory and Practice

Nataša Jelen
Tončke Čeč Primary School, Trbovlje, Slovenia

Angles in a polygon

Irena Jelenko
Brezno-Podvelka Primary School, Podvelka, Slovenia

Challenge - Circuits

Irena Jelenko
Primary School Brezno-Podvelka, Podvelka, Slovenia

Test in the form of a group work

Mikołaj Kałdan
Primary School, Kraków Montessori School, Kraków, Poland

The use of inquiry based practical work on student's understanding of classifying conductors and insulators

Jennifer Kelly
Scoil Pol Kilfinane, Ireland

Line or stap?

Mateja Kelner
Ljudski Vrt Primary School, Ptuj, Slovenia

Inquiry of soil

Mateja Kelner
Ljudski Vrt Primary School, Ptuj, Slovenia

We learn to ask. How does working on students' questions bring us closer to a well-posed inquiry question?

Roman Klara
Podkarpackie Centrum Edukacji Nauczycieli w Rzeszowie – Oddział w Krośnie, Katolickie Liceum Ogólnokształcące w Krośnie, Poland

The Pythagorean theorem

Metka Klinc
Vojnik Primary School, Vojnik, Slovenia

Laying Tiles: Area of a Shape

Vesna Kotnik
Vojnik Primary School, Vojnik, Slovenia

Geometric mathematical problem solving

Urška Krajnc
Radlje ob Dravi Primary School, Radlje ob Dravi, Slovenia

Placement of an object in space using bisectors

Urška Krajnc
Radlje ob Dravi Primary School, Radlje ob Dravi, Slovenia

Modelling round bodies

Miran Kučer
Ljudski Vrt Primary School, Ptuj, Slovenia

Where in Asia would you live?

Ana Lavre
Vojnik Primary School, Vojnik, Slovenia

Angles in a triangle

Vesna Lindič
Tončke Čeč Primary School, Trbovlje, Slovenia

How to keep a large, busy class motivated for maths?

Blomme Maes
OLVP Bornem, Belgium

A model based approach to give a deeper understanding of aspects of atomicand particle physics

Denis McCarthy
Hazelwood College, Ireland

Effect of Peer Feedback on Higher Academic Achieving Students in Mathematics

Larissa O'Neill
Kildare Town Community School, Ireland

Circumference and Area of Shapes

Jasmina Petek Pelcl
Ljudski Vrt Primary School, Ptuj, Slovenia

What will the Pythagorean Theorem do for me?

Špela Povše Pistotnik
Gymnasium, Electrical and Maritime School Piran, Slovenia

How does the development of note-taking skills affect the effectiveness of learning biology in cytology by first-year high school students?

Beata Sobocińska
XLII Liceum Ogólnokształcącego im. Adama Mickiewicza w Krakowie, Krakow, Poland

How to improve the calculus proficiency of a high school student

Beata Świder
Eugeniusz Romer High School in Rabka-Zdroj, Poland

To what extent working with the same physics teacher in primary and secondary schools affects the efficiency of teaching this subject

Małgorzata Szymura
Complex of School in Czerwionka-Leszczyny, Czerwionka-Leszczyny, Poland

Light and Shadows

Nataša Škorjanc
Vojnik Primary School, Vojnik, Slovenia

Heating and Cooling Substances

Jure Štokovnik
Vojnik Primary school, Vojnik, Slovenia

An inquiry on the effect of wonder on the motivation of students and their ability to ask questions

Wannes Vande Voorde
Arteveldehogeschool, Gent, Belgium

How can you ensure that students work independently in class and remain motivated?

Femke Vanden Broecke
Imacolata, Ieper, Belgium

Areas of Quadrilaterals

Simona Verdinek Špenger
Brezno-Podvelka Primary school, Podvelka, Slovenia

Discount-price increase or price increase-discount

Simona Verdinek Špenger
Brezno-Podvelka Primary School, Podvelka, Slovenia

How can you evaluate an out of school engineering academy?

Ruben Visser
Arteveldehogeschool, Gent, Belgium

How the diversity of methods of work affects the interest and level of understanding of physics laws by first-year high school students? - on the example of Newton's second law of motion

Dorota Zbijewska
Liceum Ogólnokształcące Sióstr Urszulanek Unii Rzymskiej, Wrocław, Poland

Dependence of quantities is a function

Sonja Zorman Grabner
Koroški Jeklarji Primary School, Ravne na Koroškem, Slovenia

How does the use of own notes during tests affect students' performance in physics?

Author: ***Anna Bekas***
anna.bekas.sp62@gmail.com
Primary School No.62 im. kmdra. por. F. Dąbrowskiego in Kraków

INTRODUCTION

As part of the STAMPEd project, from October 2022 to March 2023 at Primary School No. 62 im. kmdra. por. F. Dąbrowskiego in Kraków, an educational study was carried out in the Practitioner Inquiry (PI) strategy, during which attempts were made to answer the above research question.

EDUCATIONAL RESEARCH

Implemented topic: Mechanical vibrations and waves & Electrostatics

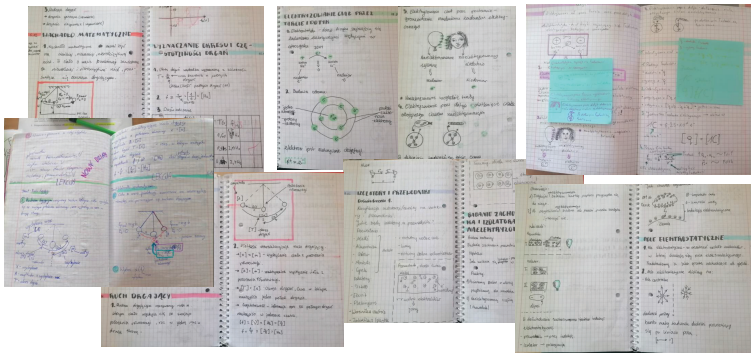
Research group:

- **Grades 8** (14-year-olds)
- 8a (16) -> 8 girls and 8 boys,
- 8b (16) -> 10 girls and 6 boys,
- 8c (18) -> 8 girls and 10 boys.

Research tools:

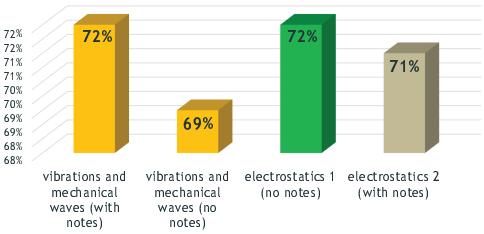
- Test on the topic Vibrations and mechanical waves **with notes** (students informed a priori).
- Test on the topic Electrostatics 1 **without notes.**
- Test on the topic Electrostatics 2 **with notes** (students not informed a priori).
- Evaluation survey.
- Observation + notes.
- Data analysis and application processing.

Student's notes - Mechanical vibrations and waves & Electrostatics

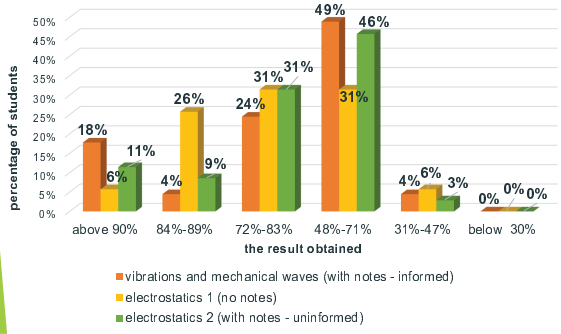


ANALYSIS OF RESULTS

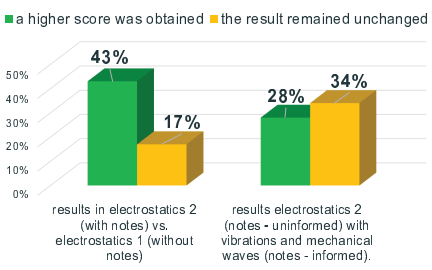
The average of students' test grades



Test results - *the percentage of students who obtained a given result in the indicated ranges*



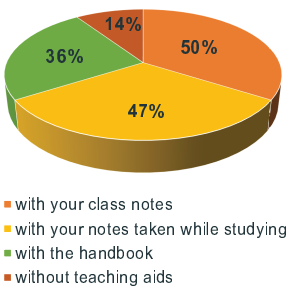
Comparison of tests - *analysis of the results of individual students*



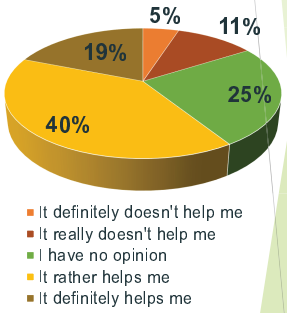
EVALUATION SURVEY

What is your favorite way to complete the test?

**multiple choice of answers possible*



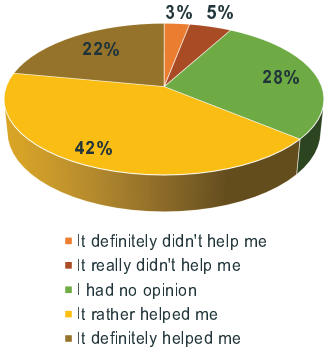
To what extent does the use of notes help you in writing tests?



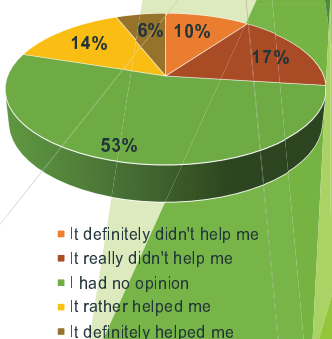
- *"It's best to use your own notes because we know where everything is."*
- *"You can learn to take, use notes, and find information"*
- *"I feel better with notes because I know that if I forget something, it will be in my notebook."*
- *"The notebook notes are written by me, so they are written in language and phrases that I understand and make sense to me. The notes I take while studying I do to organize the messages in my head, so they are arranged and all the most important knowledge in a given department is in one place, clear and transparent."*

- ❑ *"With notes, I can't show what I really learned."*

To what extent did being informed in advance about the possibility of using your notes during the test on *Vibrations and mechanical waves* help you use them effectively during the test?



To what extent did the lack of awareness that you would be able to use your notes on the test on *Electrostatics* make it difficult for you to use them during the test?



FINAL CONCLUSIONS

1. Most students admit that using their own notes helped them during tests - approx. 60%
2. The use of notes does not have a significant impact on the average results of classes, but it is of great importance for individuals - about 40% achieved better results
3. Students emphasize how important it is that these are their notes, which they will analyze and supplement with their own observations while learning.
4. The respondents also pointed out that even if they do not use the notes, just the awareness of the possibility of using them calms them down and allows them to focus on tasks.

Physics teacher **Agnieszka Bożek**
VIII LICEUM OGÓLNOKSZTAŁCĄCE
IM. STANISŁAWA WYSPIAŃSKIEGO W KRAKOWIE

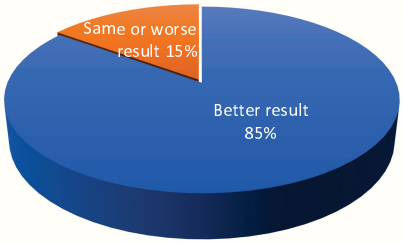
Study conducted in the first and second grade high school classes with an extentention in physics

How collaboration between students during physics lessons affects teaching results.

Test results - the Idea is born

Students who had performed well in a kinematics test become tutors for others. Re-test showed significant increase in grades.

RE-TEST results

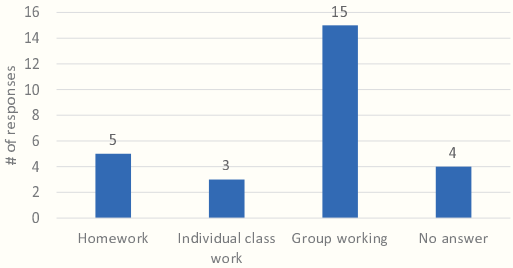


Next step:
solving calculation tasks in small groups of three

- **Observation**

All students worked willingly and with commitment, although at different pace. They explained more difficult issues to each other, the work took place in a good atmosphere.

- **Mini survey** – which form of working suits you best?



- **Discussion**

how to learn to solve tasks in the most effective way?

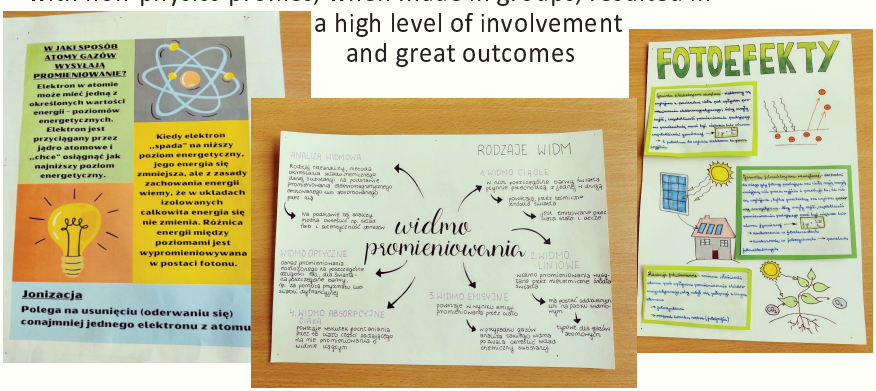
Most effective according to students → Exemplary solution by the teacher → Homework → Work in groups

- **Comparison of learning effects before and after**

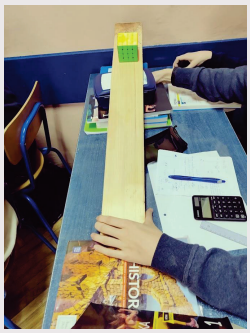
students cope better with tasks, they no longer receive unsatisfactory grades

Examples for group-based repetition

Racaps of topics in Atomic Physics, notoriously difficult in groups with non-physics profiles, when made in groups, resulted in a high level of involvement and great outcomes

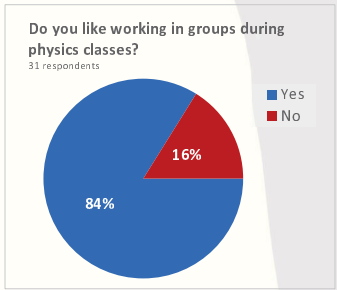


Idea follow up – students' experiments in small groups

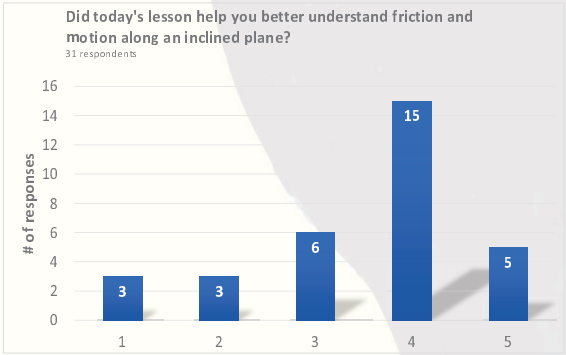


In groups of three, students were asked to design experiments with inclined planes. Some were simple, some sophisticated.

Survey after experiments in small-groups



After the experiments with inclined planes, students were asked for their opinions. They were overwhelmingly positive, indicating the usefulness of the method for understanding the new topic.



Strengths of learning in groups

Surveyed, students responded with the following pros:

- Ability to solve problems together
- Mutual help and explanations
- Ideas sharing
- Facing problems not typical for ordinary lessons
- Integration, fun. A lighter, more interesting form
- Doing own experiments/developing creativity

Let`s Play

Mojca Buršič, prof.
OŠ Vojnik

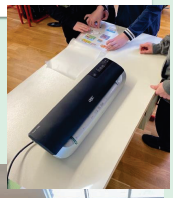
With students in English language classes, we have been reinforcing vocabulary and different language patterns through a variety of activities since the first grade. Most of these activities are usually entirely or at least partially created and provided by the teacher. In this activity, fifth-grade students themselves have created board games to help them consolidate their language skills in English class.

INTERESTED:

Do the students have knowledge of various language skills covered in the unit "In the town"?
Do they understand the difference between simpler and more complex language skills?
Do the students collaborate and know how to allocate tasks?
Can they create games that can be played at different levels of difficulty?
Do they independently seek creative solutions?

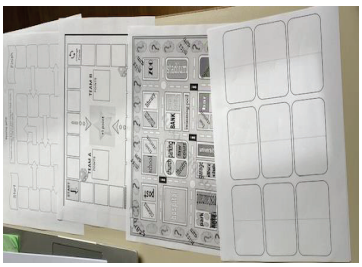
RESEARCH PLAN:

Observation of students during their work.
Collection of evidence, including their creations.
Oral self-evaluation by students in groups.



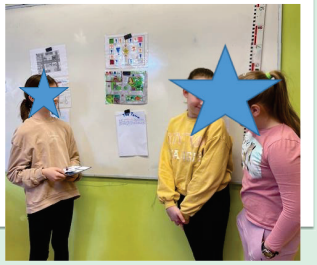
STUDENTS` ACTIVITIES in the lessons:

1st: Ideas and Planning



2nd: Game Creation

3rd lesson: Playing and Self-Evaluation



FINDINGS

I have found that:

- The students have a good knowledge of vocabulary, prepositions, and language patterns for describing a town.
- The students were successful in proving the hypothesis that language skills can be reinforced through board games.
- The students successfully planned, predicted, and created games.
- Some students were partially successful in adapting the games to different levels of knowledge.

CONCLUSION

Through the investigation of my own practice, I wanted to determine whether the students already had sufficient knowledge of vocabulary and language patterns in a specific teaching unit, as well as how they would apply them in a new context of creating board games. It is evident that they understood the material well and were able to differentiate between less and more complex language skills.

Following precise instructions, the students collaborated effectively in groups, independently assigning tasks and demonstrating their predictions through their creations. The groups occasionally required guidance or prompts through questions. The biggest challenge for them was game differentiation. Nonetheless, three groups showed a high level of creativity, while one group required more encouragement.

Although this approach requires a significant amount of class time, it fosters creativity and proves to be effective for learning. This was evident in the assessment, as the majority of students demonstrated excellent comprehension and application of the required language skills. Continuing similar activities is certainly worthwhile, and I will emphasize this during the English teachers' meeting.

Osnovna šola VOJNIK
Prušnikova 14, 3212 Vojnik
Univerza v Ljubljani Pedagoška fakulteta

Alan Casey
Coláiste an Chroí Naofa, Carraig na bhFear

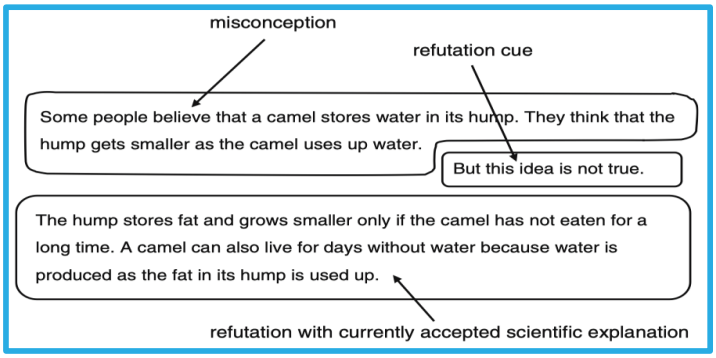
Can the Use of a Refutation Text Increase Students' Understanding Earth and Space Science?

QUESTION

The goal of this inquiry is to determine when teaching a group of transition year students(15-16 years) studying Physics about Earth and Science; 1) if using a refutation texts during instruction will enhance their learning and understanding of the topic and 2) provide a tool to students to allow the to develop their skill in generating an explanation.

Refutation Text – what is it ?

A refutation text is a short text that states a misunderstanding and refutes(corrects) it using the accepted scientific explanation.



The twinkle of stars

"Some people believe that stars twinkle just like it says in Twinkle Twinkle little star "

This is not correct because

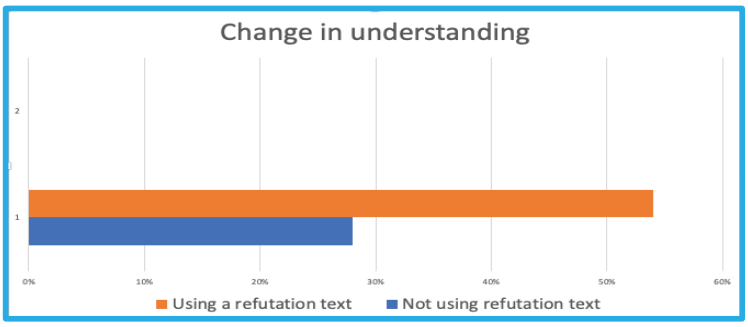
Stars do not twinkle. It is an optical illusion caused by the atmosphere. When the light ray from the star reaches the earth's atmosphere, it is refracted ("bent", remember the pencil in a beaker of water) as it goes through a different medium. The Atmosphere is not one medium but many due to the different atmospheric conditions, so the light travelling from the star to our eye, takes a zig zag pattern through the atmosphere, creating the illusion of twinkling.

The impact of the moon on tides

"Some people believe that the tides on earth are only caused by the moon.

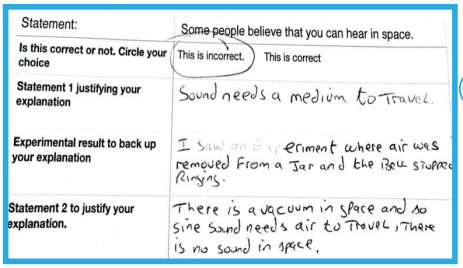
This is not correct because

The tides on Earth are caused by the Sun and the Moon. While the moon applies a gravitational force to the earth causing tidal forces , the Sun also has gravitational impact on the earth causing tidal forces. The Sun and Moon tidal forces are added together to give the tides. So if the moon disappeared, there would still be a tide generated by the Sun, however it would be much weaker due to the absence of the moon.

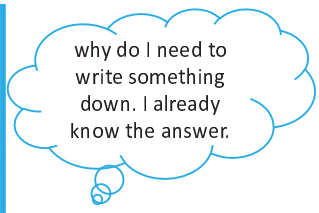


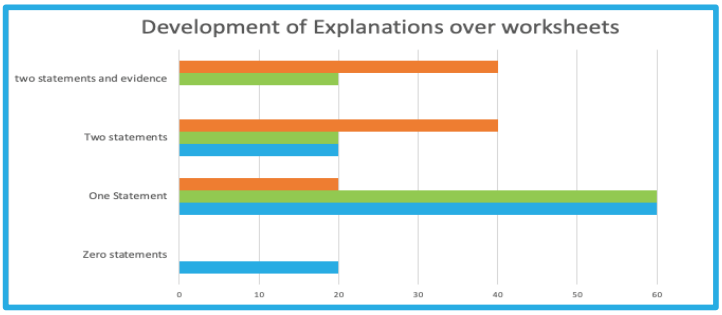
Develop an explanation

Students struggle with providing explanations, the refutation text structure allows students to create an explanation using statements and evidence.



Statement:	Some people believe that you can hear in space.
Is this correct or not. Circle your choice	This is incorrect. / This is correct
Statement 1 justifying your explanation	Sound needs a medium to Travel.
Experimental result to back up your explanation	I saw an Experiment where air was removed from a Jar and the Bell stopped Ringing.
Statement 2 to justify your explanation.	There is a vacuum in space and so since Sound needs air to Travel, there is no sound in space.





Conclusion

1) Refutation texts can help to support student understanding when used to counteract the misunderstandings that exist in prior knowledge.
2) They are useful as a tool to help students develop the ability to write an explanation in which a large number of students struggle initially
3) They do not need to be word based, but can also use diagrams, pictures etc.
4) They can be used for any subject to leverage the misunderstanding from a negative to a positive reinforcement.

Erasmus+
2020-1-SI01-KA226-SCH-093576

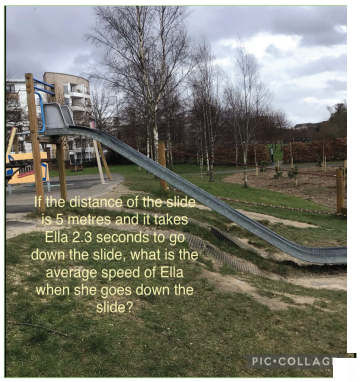
Peter Cummins
Edmund Rice College Dublin

How does the use of visual strategies with student-generated questions impact student understanding in Speed/Distance/Time and Trigonometry (Student Age: 13 Years)?

Context:
Two classes of 24 mixed ability students per class. Massive grade drop from 1st to 2nd year Maths (summer summative assessment – students aged 12-13). Speed/distance/time and trigonometry are two topics that students appear to find difficult. This initiative investigates whether visual strategies and student-generated questions allow a student to grasp concepts that they would otherwise struggle with. In addition, this initiative looks at student feedback on generating their own images and question on these two topics.

Plan:
- Students examine photos to look for shapes and variables that they can measure.
- Students have a site visit (playground) and take pictures.
- Students generate questions from their pictures, solve them using DST formula, Pythagoras, Sin/Cos/Tan, etc.
- Students use their questions / solutions to teach and challenge their peers.
- Students experience traditional (textbook) questions requiring the same knowledge to solve.
- Results recorded.

Visual Strategy and Student-Generated Questions



Traditional (textbook / exam-style) Questions

47. What is the speed of a ball that travels 49 meters in 2.4 seconds?

48. Which has a greater speed, a ball rolling down a 3.4 meter hill in 6 seconds or a fish swimming upstream and covering 5.4 meters in 0.4 minutes?

49. How long does a horse take to walk to water 6 km away at a speed of 20 m/s.

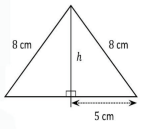
50. If Dungarvan Shopping Centre is 300 meters long and you walk at a pace of 1.3 m/s, how long will it take you to walk from one end to the other?

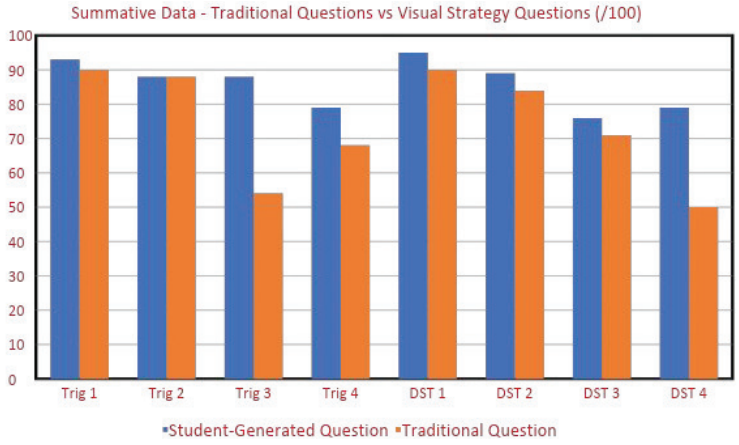
51. If my toy train in class can move at a speed of 0.04 m/s, how long will it take for the train to move 5 meters?

52. You arrive in my class 45 seconds after leaving math which is 90 meters away. How fast did you travel?

53. How far can you get away from your little brother with the squirt gun filled with paint if you can travel at 3 m/s and you have 15s before he sees you?

(e) Use the theorem of **Pythagoras** to find the value of h, the perpendicular height of the isosceles triangle shown in the diagram below. Give your answer in cm, correct to one decimal place.





Student Responses

Good fun and I understand it now.

Quicker the old way. This took a long time.

I prefer the questions we made. They are easier than the book ones.

I liked the activity but more work for an easy topic.

Findings:
Students enjoyed the activity. All students performed better using the visual strategies and student-generated questions. However, the initiative took approximately 3 times longer to complete. High achievers wouldn't like to repeat. I will use again……possibly 2/3 topics per year for each JC class (Students Age 12-15).

Co-funded by the Erasmus+ Programme of the European Union
Grant agreement no. 2020-1-IE01-KA201-066069

RESEARCH QUESTION

What is the effect of using Student Question Based Inquiry (SQBI) on the quality of student questions in science lessons and students' curiosity?

Basic info

ME: intern mathematics and biology

SCHOOL: Sint-Jozef Sint-Pieter Blankenberge iPadschool, welcoming teacher team

CLASS: 1st year, 19 pupils. Enthusiastic, well-behaved and studious class. Pleasant contact.

CONTEXT

During previous internships, it was often noticed that the scientific research method feels artificial for pupils and that there is no focus on curiosity at all. The process is strongly controlled and pupils do not understand the point of all the steps (research question, hypothesis...).

INVESTIGABLE QUESTIONS

- What will happen if…?
- What is the influence of…?
- What is the connection between…?
- Does … make a difference in…?

ACTION

METHODOLOGY

1. Workshop on asking researchable questions

Lessons before and after the workshop were recorded. Student questions were listed, counted and categorised.

2. Teaching method

Lesson started by listening to students' questions on the topic. Questions were noted and pupils' attitude was observed during that lesson.

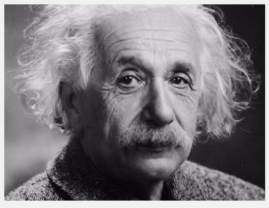
RESULTS

Type of question	Recording before workshop	Recording after workshop	Questions teaching method
Investigable questions	0	0	1
Relevant content questions (non-investigable)	1	6	0
Irrelevant questions	1	0	0
Content clarification	0	5	1
Clarification objectives	0	1	0
Clarification instructions	3	3	0
Asking practical guidance	9	n/a	n/a
Deepening content (open)	0	0	2
Deepening content (closed)	0	0	2
Total	14	15	6

+ Great enthusiasm from pupils during teaching method.

- "If I had an hour to solve a problem and my life depended on the solution I would spend the first 55 minutes determining the proper question to ask for once I know the proper question I could solve the problem in less than five minutes."

  - Albert Einstein



CONCLUSION FROM THE ANALYSIS OF THE RESULTS

1. Giving pupils a place for their curiosity has a great effect on the type of questions they ask(more in-depth and investigable questions during teaching method). This also strongly depends on the type of class group.
2. Lessons before and after the workshop were of different nature and this greatly affected the types of student questions. This makes it difficult to draw conclusions about the effect of the workshop itself. More data would have been needed.
3. During the teaching method, only the questions of pupils who raised their hands were noted, so the collection is not accurate. It's better to collect them all in the future.
4. Difficulty internship context:
   a. Practice problem chosen before acquaintance with the context
   b. Tight schedule, little freedom for order of lessons

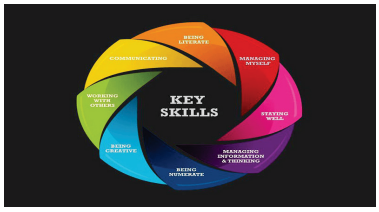
Closing remarks

- Giving pupils a moment to reflect on their own interests and their questions about a topic, depending on the group, can have a positive effect on curiosity and motivation during the lesson.
- It feels uncomfortable for students to dwell on asking questions for so long. This crucial part of science does not always have a big place in education.
- Practice research is trial and error. A lesson is influenced by a large number of factors and you can never control everything.
- This was a very special first encounter with practitioner research. It will be interesting to continue this in the future.

Kristian Dimitrov

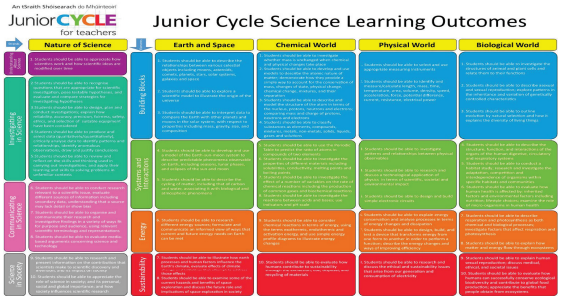
St. David's CBS

Introducing Inquiry-Based Learning (IBL) to students



Irish Context

- Experiment given to 2nd year (14/15 year old students)
- Lesson was given with the Junior Certificate Key Skills and Science Specification in mind



IBL explored

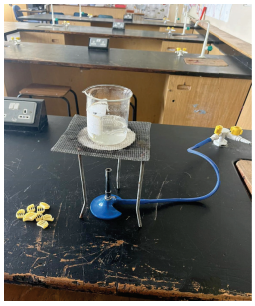
- **A**im: Encourage students to be more independent when doing experiments
- How: By using creating an investigation using common occurences

Activity and Question

- Experiment: Investigating the change of mass as pasta gets boiled
- Time taken: 3 hours/ classes
- Hour 1: Preparation
- Hour 2: Experimentation
- Hour 3: Results Interpretaion

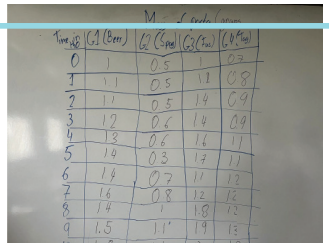
Hour 1: Preperation

- Students are put in groups
- Question was given: What happens to pasta when it is cooked
- Ask students how wecan investigate and see if it is true
- In their groups have students come up with a
  - Hyptheisis
  - Equipment needed
  - Safety
  - Method
- Discuss what was done in groups as a class



Hour 2: Experimentation

- Give time for the students to perform the experiment
- As students are experimenting, go around and to guide and focus the students



Hour 3: Results Interpretation

- Make every student draw a graph to represent the data collected via the experiment
- Have each group share the data collected
- Have a class discussion about the results- was it what was expected etc. and reflect on the experiment

Reflection

- Let students have more freedom when trying to perform the experiment

Conclusion

- Incorporating IBL is good as
  - It makes students more confident in the lab
  - It shows that science is everywhere
  - It gives students more appreciation for the work that goes into making experiments

CASTeL Centre for the Advancement of Skills Teaching and Learning

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RISE 2020-1-SI01-KA226-SCH-093576

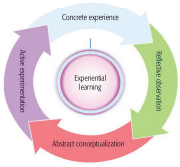
Stephen Gammell
Scoil Chonglais, Baltinglass, Co. Wicklow

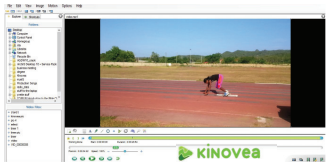
How does connecting learning between physics, mathematics and the real world, support students to develop an understanding of rates of change?

Experiential Learning

"…learning in which the learner is directly in touch with the realities being studied. It is contrasted with the learner who only reads about, talks about or writes about these realities but never comes into contact with them, as part of the learning process"

Tate and Keaton (1978), Kolb (1984)





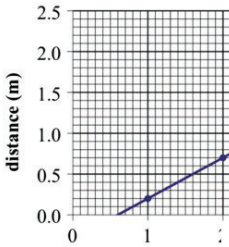
Student difficulties with Speed, Distance & Time

A ball moves along a track. The graph at right shows the distance from the ball to a fixed point during a number of seconds.

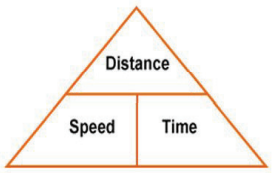
a. Is the ball *moving away from, moving towards,* or *not moving* with respect to the fixed point? Explain.

b. Is the speed of the ball *increasing, decreasing*, or *constant*? Explain.

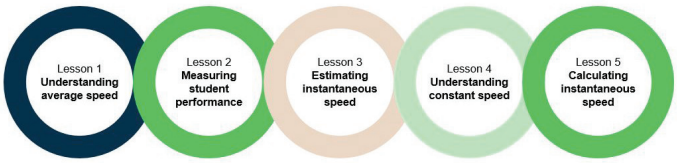
c. What is the speed of the ball at $t = 3.0$ s? Explain.



Wemyss & Van Kampen (2013)



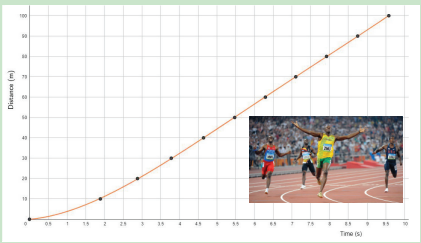
Unit of Learning



Lesson 1 – Understanding average speed

How fast did Usain Bolt run?

Did he run at the same speed through the entire race?



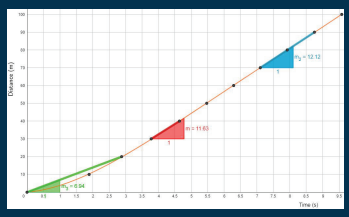
Students calculate Usain Bolt's speed using their preferred approach, before discussing what their results means with respect to the entire race and its implications for our definition of speed.

Students develop an understanding of average speed, including misconceptions resulting from the Distance – Speed – Time triangle, how average speed manifests on a graph and the formal definition of average speed.

$$\underset{between\ a\ \&\ b}{average\ speed} = \frac{distance\ travelled}{time\ taken} = \underset{between\ a\ \&\ b}{slope\ of\ secant}$$

Lesson 2 – Measuring Student Performance

Design and carry out an experiment to measure your own athletic performance.



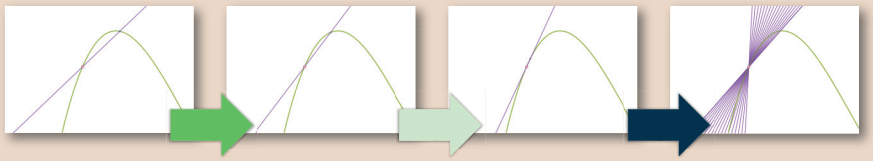
Students record and graph their 10m split times, then calculate slope to analyse their average speed over different stages of 100m.

Students develop an understanding of how choosing different secants allows us to calculate the average speed over different durations.

Lesson 3 – Estimating Instantaneous Speed

How fast did you run exactly 1s into the race?

Students calculate the slope of secants formed closer and closer to the 1s point to provide better estimates of speed at 1s.



Students develop an understanding of how the slope of secants formed closer to a point provide better estimates of the speed at that point, but see that this approach breaks down when you apply it to a single point. This leads to the idea that the slope of a tangent is the instantaneous rate of change and motivates the need for Calculus.

$$\text{speed at a single point} = \frac{0}{0} \quad \text{which is undefined}$$

Opportunities provided by this approach

For students:

Develop conceptual understanding
Make connections between disciplir
Develop numeracy
Understand STEM

For teachers:

Collaborate in lesson planning and desigr
Develop cross-curricular knowledge

Next steps

In what ways does this approach influence student learning across the domains of:

- **Knowledge**
- **Skills**
- **Attitudes and values**

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development / David A. Kolb. Prentice-Hall.

Tate, P. J., & Keeton, M. T. (1978). Learning by Experience—What, Why, how Morris T. Keeton, Pamela J. Tate Editors. Jossey-Bass.

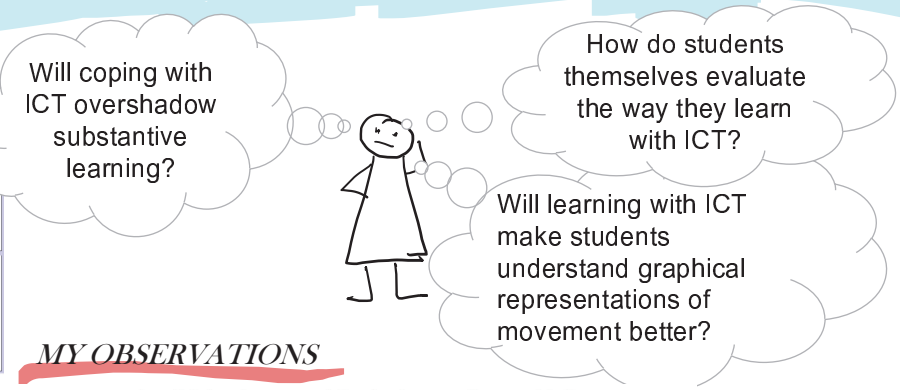
Wemyss, T., & Van Kampen, P. (2013). Categorization of first-year university students' interpretations of numerical linear distance-time graphs. Physical Review Special Topics - Physics Education Research, 9(1), 010107.

Co-funded by the Erasmus+ Programme of the European Union
Grant agreement no. 2020-1-IE01-KA201-066069

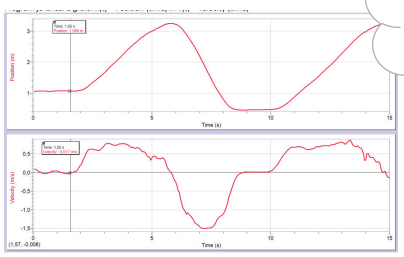
Movement with ICT

Špela Gec Rožman, prof. fizike
Gimnazija, elektro in pomorska šola Piran

Teaching and learning have recently been increasingly oriented towards the use of information and communication technology (ICT). Teaching has become "wildly digitalised" and, given the developments in science and technology, this cannot and perhaps should not be avoided. Personally, I have considerable doubts about this. Is the knowledge acquired in this way of the same quality? Equally as useful? Is it deficient? How do students accept this way of learning and is it suitable for all or even most of them?



Activity 1: MOVEMENT CHART



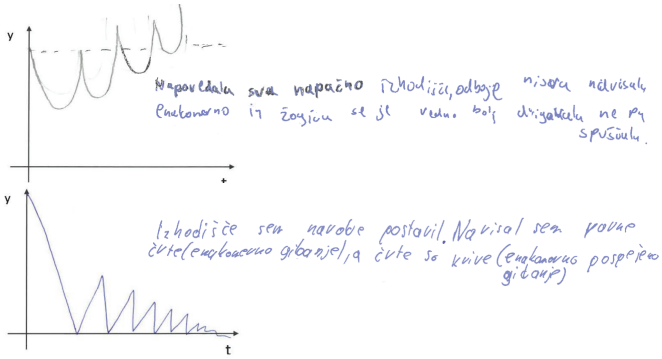
Students have to use their own body movements to draw the graph as instructed:

The student stands still in front of the sensor at a distance of 1 m for the first 2 s. In the next 4 s, he moves away from the sensor by 2 m, moving steadilyIn the next 2 s, he/she approaches the sensor at a distance of 0.5 m and remains stationary there for 2 s. After the standstill, it starts moving away from the sensor at a speed of 0,5 m/s, moving away until the end of the observation.

They must read off the positions from the graph x(t) and calculate the displacement and the average velocity over each segment. They sketch a graph of v(t) and compare it with the measured one.

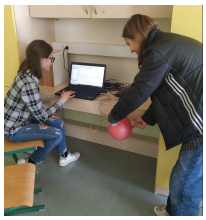
MY OBSERVATIONS

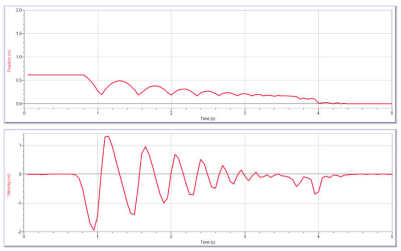
1. NAPOVEJ!: Nariši, kako se bo spreminjala lega kroglice v navpični smeri y(t) – žogico spustim, nakar se od tal nekajkrat odbije.



(Instruction: predict the shape of the graph, do a video analysis and comment on the discrepancies observed) Most students have great difficulty writing down the prediction at the beginning, they are unsure, afraid of making mistakes. The more successful students are more self-critical when evaluating their work.

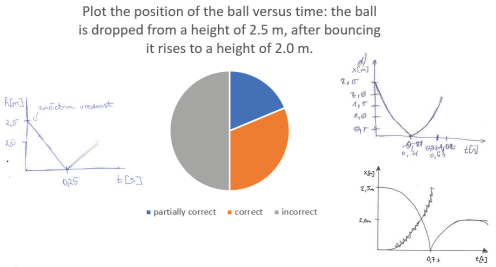
Activity 2: FREE FALL



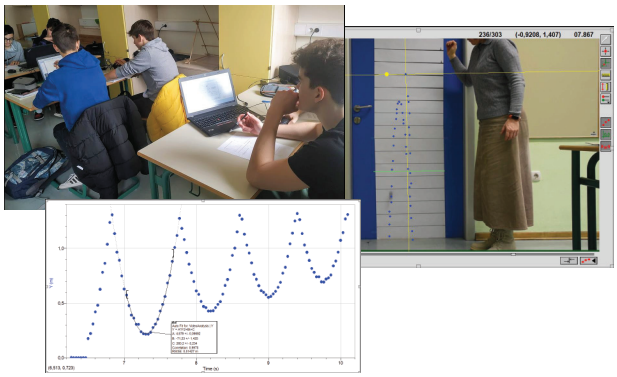


The ball is dropped under the position detector and the position of the ball is recorded after several bounces. Interpret the graph using the instructions, determine the magnitude of the acceleration from the slope of the lines in the graph v(t).

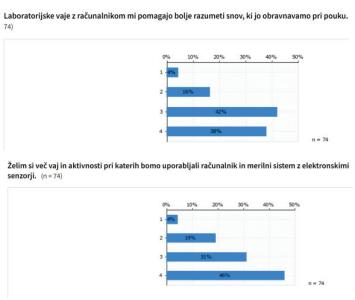
Evaluating underperforming students: 16 students who scored insufficient in the previous assessment wrote the paper. Half of them drew the graph correctly or partially correctly.



Activity 3: VIDEO ANALYSIS



Students understand the meaning of FPS, determine photo distances and choose the correct coordinate system orientation. They predict the appearance of a graph in advance, perform video analysis of a shot, interpret the graphs and compare the predictions. They change the orientation of the coordinate system and observe how this affects the shape of the graphs.



Evaluation questionnaire: students' opinion on ICT learning. 74 students responded, the percentages below are the total of those who marked (3) or (4) as agreeing with the statement (four-level scale)

84% - the equipment used is easy to use
80% - ICT lab exercises help understanding of the material
45% - using ICT confuses me
*79% - I like ICT exercises better than traditional ones
77% - I would like to see more ICT activities in physics lessons

* Students later said that they had misunderstood the question and the true percentage would actually have been lower

Students have embraced ICT learning well, and I personally think they are more confident, if not more successful, at reading graphs than generations before them. Organizationally, we have been creative and successful, and the learning of digital content has been well blended with the exploration of movement. According to the results of the evaluation I carried out with the students, they are keen to continue with such activities in the future and are not afraid or hindered by working with the measurement system used.

Final Conference RISE: The Faculty of Education of the University of Ljubljana, 27. and 28. of June, 2023
The activities were performed with measuring equipment from Vernier Science Education.

K. Appel, J. E. (2003). *Physics with Computers.* Beaverton, Oregon: Vernier Software & Technology.

Gerard Hughes
Ballymakenny College

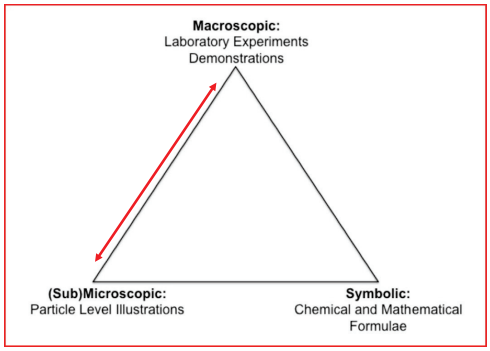
Supporting students to develop hypotheses and plan investigations through the context of learning about factors required for chemical reactions.

Context and Challenge

This poster presents my approach to support students to understand factors required for chemical reactions whilst developing their inquiry skills, in particular, developing hypothesis and planning investigations. These aspects are related to the 'chemical world' and 'nature of science' learning outcomes of the Irish Junior Cycle Science Specification for 12-15 year-olds. I developed this approach because I've noticed that students often struggle with understanding variables, experimental design and abstract chemistry concepts.

Abstract nature of chemistry

Students find it difficult to understand chemistry phenomena they can't visualise. Alex Johnstone proposed that students should be supported to look at new phenomena at different levels to help them understand the concept.



Johnstone's Triangle

My Approach

I used the example of baking pancakes to introduce students to experimental design and understand factors for chemical reactions.

Students had to plan and design how they could make a pancake considering different amounts of ingredients, temperature, time etc. This supported students to develop understanding of chemistry and inquiry skills.

Inquiry Skills:

Developing a hypothesis:

- Students are asked to suggest a possible hypothesis for each activity carried out.

Designing an experiment:

- Learners must evaluate their own methods and ensure that their experiment is a fair test.

Conclusion:

- Students state a conclusion for each activity that connects their observations to the hypothesis.

Factors required for reactions:

Phase of reactants:

Powdered milk is used instead of low-fat milk. This reveals that there must be an aqueous solution which will act as a medium for the reaction.

Limiting reagents:

Different volumes of flour is used to show that reactants are required to form the desired amount of product.

Temperature:

By comparing the changing of pancake batter at different temperatures, the requirement of activation energy can be seen.

Amount of reactant

This is important to show that an increase in particles of reactant will lead to more collisions hence more reactions

Findings

- Students found the analogy to baking helpful when looking at chemical reactions
- Students better understood the need to only change one variable at a time
- Analogy was also helpful for students to understand how to write a hypotheses

Additional Benefits

Approach allows students to develop other key skills such as Communication, Working with others, Being creative and Being numerate

Follow on lessons:

- Rates of reactions and associated factors i.e. concentration, temperature, surface area
- Milliard's reactions

Erasmus+
RISE 2020-1-SI01-KA226-SCH-093576

PHYSICS PHENOMENA – CONNECTION OF THEORY AND PRACTICE

Nataša Jelen
OŠ Tončke Čeč Trbovlje

I find that most students, whatever the subject, find it much easier to learn a subject by heart, and then most often "fail" to put that "knowledge" (which of course it is not) into practice. So they were given the task of first theoretically describing selected physical phenomena (only one per student), then demonstrating them with an experiment and, of course, explaining these experiments.

1. Motivation: what I was interested in.

In particular, I wanted to know whether the pupils, using the knowledge they have acquired over the last year and a half, and with the help of literature and the media, were able to select a relevant physical phenomenon that is often encountered in nature, explain it theoretically and demonstrate it with a practical experiment.

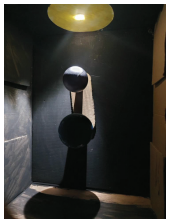
I looked at how or according to which criteria students choose phenomena, how they are able to find the necessary information in literature and media or even know it from school material, or are able to link theory and practice, or know the role and purpose of the elements and tools in the experiment, or if they are able to "translate" the experiment into nature or equate it with natural phenomena. I was interested to see how imaginative and skilful they would be in modelling the phenomenon they would present.

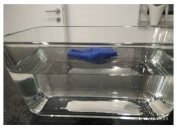
2. About student activities

The students first chose a physical phenomenon - I found that most of the time it was based on whether it was observable on the days they chose it, or whether they had encountered it in their own home. They then wrote down theoretical observations about the phenomenon, and pictures of the phenomenon in nature were also encouraged. The pictures were to be taken by the participants themselves (at the time or at some previous time), not from the internet.The icing on the cake was a practical experiment to confirm the theory. The pupils also photographed and explained the experiments.







3. Collected data and findings

If I look at the tasks very loosely, I can say that I am very satisfied with the material I have received. Some of the students handed in really well done assignments, and when they explained how they designed the experiment, why they did it that way, what the different elements and devices in the experiment represented, it was clear that they really understood the subject and were able to summarise it. When they explained to me why they had chosen a particular physical phenomenon, the answers were very much 'my kind of thing': because they liked it, because they already knew something about it, because they remembered when we discussed it in class, because they found it interesting, because it immediately came to mind how to do a practical demonstration, and so on. Of course, there were quite a few tasks that I could not be impressed with, and what is more, I felt a real disappointment. These were tasks done in half an hour or even less, even though they had five weeks' time. They described very relevant physical phenomena, but they were explained in a 'homespun' way, or they used highly technical terms or complicated equations which, of course, the pupils could not explain when I asked them what they meant. However, it has to be admitted that these students (at least some of them) showed a good deal of ingenuity - e.g. a rainbow was shown by photographing coloured glass, cigarette smoke instead of fog was in a bottle, etc.

4. Conclusions:

In this assignment, I actually wanted to see how much students learn to find sources, think, reason and make connections between knowledge and facts after taking physics lessons for almost two years. The study confirmed what I already knew: students who generally try hard in class and really want to learn did not have any problems with the assignment. There were two exceptions - two students who were cognitively very able, but rather disinterested in learning, did the task perfectly.

ANGLES IN A POLYGON

Irena Jelenko
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In mathematics in the 8th grade, in the chapter Polygons, students should learn and be able to use a lot of forms. Judging by experience, the rules they discover themselves are best remembered.

I WAS INTERESTED IN:

- ❑ how pupils will transfer the knowledge from 7th to 8th grade, from triangles and quadrilaterals to polygons,
- ❑ if the students would write the formula for sum of the angles of polygon using symbols?

RESEARCH INTO YOUR OWN PRACTICE

The teacher observed their work (individually or in pairs). I was mainly interested in how much they know how to write a rule after systematic data collection.

ABOUT THE STUDENTS' ACTIVITIES

With the help of a worksheet, paper, a geotriangle and scissors, the students looked for an answer to the research question: How do we calculate the sum of the interior and exterior angles of a polygon?

First, by drawing, cutting and tearing paper, we repeated the sum of the interior/exterior angles of a triangle, which they know from the previous school year. Then they looked for the sum of the interior/exterior angles of any polygon in the same way. They were helped by a worksheet (http://nermin.splet.arnes.si/files/2020/03/UL_Koti-ve%C4%8Dkotnika.pdf).

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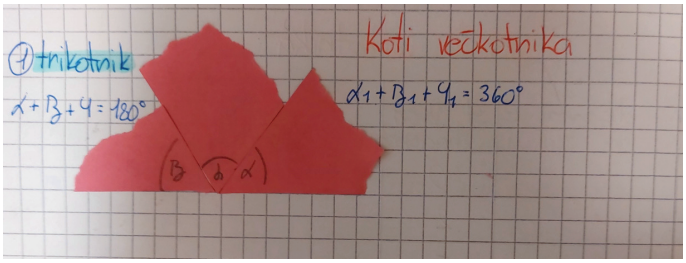
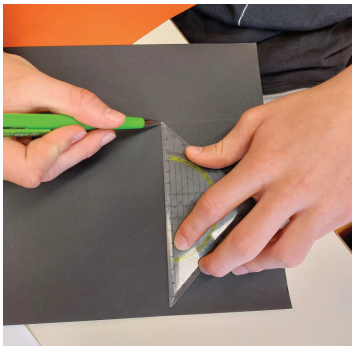
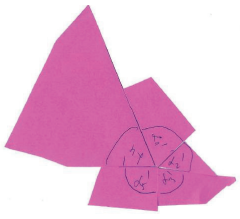
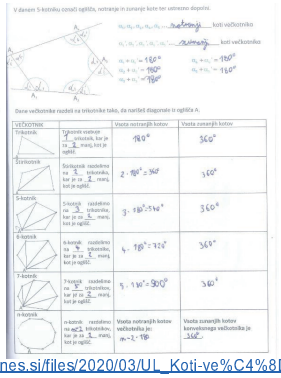


DATA COLLECTED AND FINDINGS

The students were motivated and very busy drawing, cutting, pasting and looking for rules (formulae).







http://nermin.splet.arnes.si/files/2020/03/UL_Koti-ve%C4%8Dkotnika.pdf

Out of ten students, half of them can write the rule in their own words, some need help to make the writing mathematically correct.

CONCLUSION

The students liked the research because they figured out the rule themselves. During the later knowledge test, we found that they had memorized the formula and knew how to use it.

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Final conference STAMPEd
26th - 27th of June 2023, Ljubljana
Slovenija

RISE
Univerza v Ljubljani Pedagoška fakulteta

CHALLENGE - CIRCUITS

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Students of the 9th grade in physics use experiments to study the current and voltage in a circuit in which two consumers are connected in series or in parallel. The described activity was carried out at the end of the chapter as a knowledge test - .

I WAS INTERESTED IN:

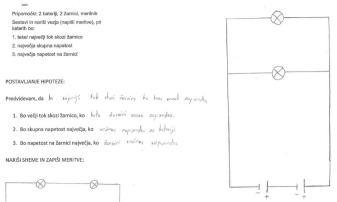
- ❑ **how pupils will transfer their knowledge to a new situation,**
- ❑ **what their expectations will be,**
- ❑ **what conclusions will they reach?**

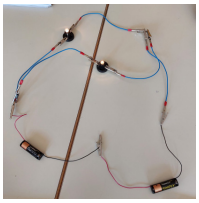
RESEARCH INTO YOUR OWN PRACTICE

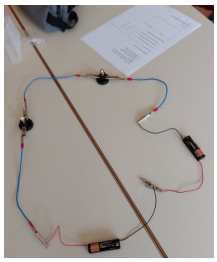
The teacher observed their work (in threes or pairs). I was mainly interested in how well they can build circuits and confirm/disprove a hypothesis.

ABOUT THE STUDENTS' ACTIVITIES

With the help of two identical batteries, two identical light bulbs and a meter, the students solved the challenge:
Assemble and draw circuits (write measurements) in which:
1. the maximum current flowed through the bulb
2. maximum total voltage
3. the maximum voltage on the bulb

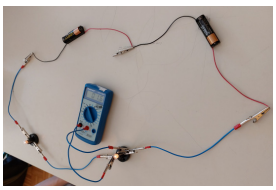


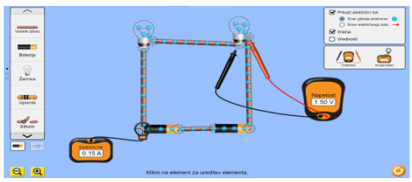


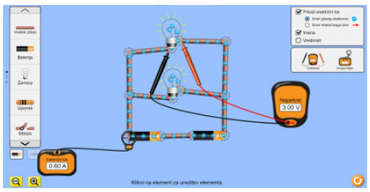


DATA COLLECTED AND FINDINGS

In physics lessons, we discussed the series and parallel connection of consumers and calculated the total current and voltage. This time the task was slightly changed, as they had to find where the total current and voltage would be the maximum. They confirmed or disproved their hypothesis by making circuits, then they also used computer simulations (https://fizikalne.simulacije.si/2015/10/31/enosmerni-elektricni-krog/**).**







Out of the fourteen pupils, most of them can confirm/disprove the hypothesis, only one group needed help to make the record physically correct.

CONCLUSION

Pupils liked the activity, as they assembled circuits (which they like to do) and tested their knowledge.

We found that they know circuits and their characteristics. I will definitely do this activity again.

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StampEd
Conference

26-27.06.2023.
Lublana, Slovenia

Test in the form of a group work

Mikołaj Kałdan

Primary school

Kraków
Montessori School
Cracow, Poland

Jagiellonian
University
Cracow, Poland

Research problem

What are the advantages and disadvantages of the test in the form of group work?

Research method

Students have written two test from the same scope of material (kinematics – 7th grade, electrostatics and current – 8th grade) once individually and once in the group of 3 to 5 people. The tests consisted of both computational and conceptual tasks.

My „lab rats" ;)

7th grade – 20 students
8th grade – 16 students

Photo: Anna Pomykalska

Types of evidence

- Tests
- Observations
- Surveys
- Interview

Source: Office 365 image bank

Impact on self confidence gain

As determined, there is no correlation between type of test and self confidence gain. However, a strong correlation was observed between reported difficulty of test and self confidence.

Impact on involvement

There was visible difference in commitment to work between used types of tests. On a scale from 1 to 10 students graded their involvement as follows:

7th grade
Individual work - 8.5
Group work - 9.0

8th grade
Individual work - 5.5
Group work - 7.2

Additional observations

Students reported that with the group work they can learn even during test from each other. They also develop their cooperation skills. As was mentioned by students level of stress during the group work is significantly lower than during individual test. What is also interesting and kind of unintuitive they compete and compare themselves with others less during and after the group work.

Source: Office 365 image bank

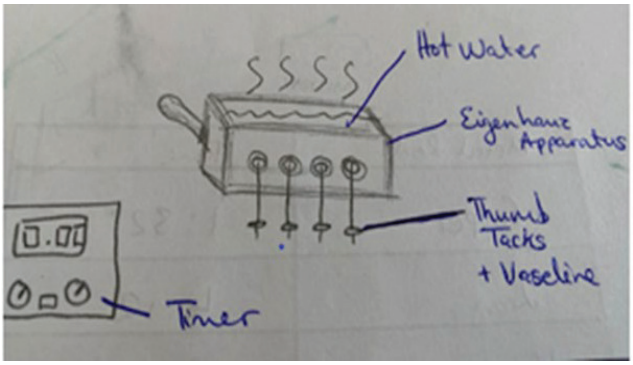
Jennifer Kelly
Scoil Pol Kilfinane

Does the use of inquiry based practical work improve student's understanding of classifying conductors and insulators?

Summary of Investigation:
Students had to plan, design and carry out an investigation to investigate the rate of conduction in different materials.

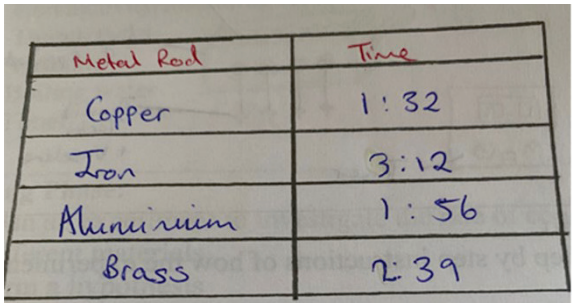
Implementation of investigation:
- The inquiry was undertaken by my transition year science class
- The class is of mixed ability (the school is a mixed gender school)
- Students worked in their regular experiment groups (mixed ability & gender)
- The inquiry took place over a two week period
- The inquiry took place over 4 one-hour classes

Collection of data:
- Class discussion
- Pair mind-maps
- Individual student pre/post survey
- Teacher observations
- Teacher field notes
- Group journal
- Individual student reflection



Group journal: Analysis & Conclusion

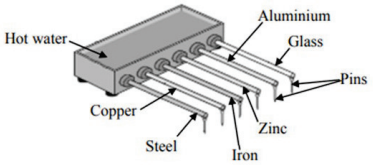
All groups detailed in words the results they collected and successfully concluded what this meant about the conductivity of each metal rod.



Metal Rod	Time
Copper	1:32
Iron	3:12
Aluminium	1:56
Brass	2:39

TY Summer exam:
In the TY Summer exam every single student who participated in the Inquiry correctly answered the followed question based on the experiment they carried out

A student set up the experiment shown below to investigate heat conduction. All the rods used had the same length and thickness. A pin was stuck on to the end of each rod. (9)



(*i*) Suggest a suitable substance to use in the experiment to stick the pins on the ends of the rods. _____

(*ii*) The pin on the copper rod was the first to fall off and the pin on the glass rod was the last to fall.
What does this result tell you about copper?

_____

What does this result tell you about glass?

_____

Co-funded by the Erasmus+ Programme of the European Union
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LINE OR STAP?

Mateja Kelner
Primary school Ljudski vrt Ptuj

Literacy, understood as an individual's ability to communicate and participate in society, is also associated with mathematical achievement and reading. It is the ability to understand and use those written language forms required by society. Readers create meaning from different forms of texts.
So I chose from the curriculum for mathematics the general goal of collecting, organizing, structuring, analyzing, presenting data and interpreting and evaluating data or results.

WHAT I WAS INTERESTED IN

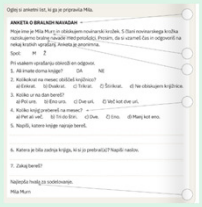
- ✓how successfully will pupils transfer knowledge from mathematics to everyday life and vice versa
- ✓whether will pupils connect the acquired knowledge in a new situation
- ✓will they connect interdisciplinary knowledge
- ✓will be the knowledge gained in this way more permanent

PLAN OF RESEARCH OF OWN PRACTICE

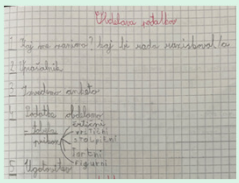
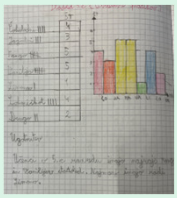
- ✓ searching for prior knowledge
- ✓ solving the survey in Slovene
- ✓ data processing
- ✓ upgrade of acquired knowledge in mathematics

PUPILS ACTIVITIES

- ✓ Learning about what is a survey?
- ✓ How it is composed?
- ✓ How we process it?
- ✓ How we present it?
- ✓ Transfer of knowledge to mathematics.
- ✓ Drawing and reading diagrams.
- ✓ Make survey, conduct a survey, process and display it.

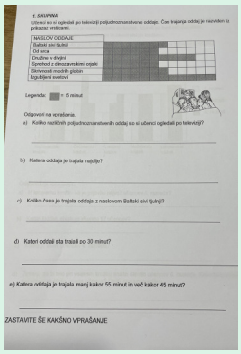
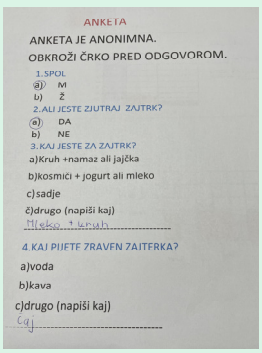


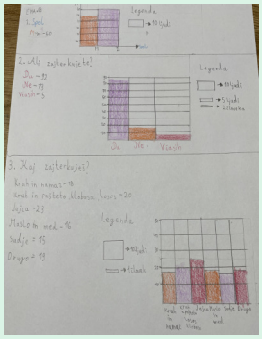
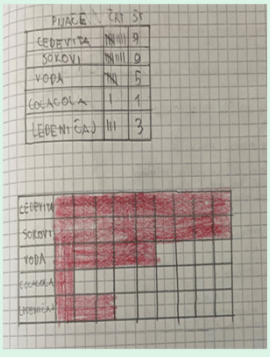
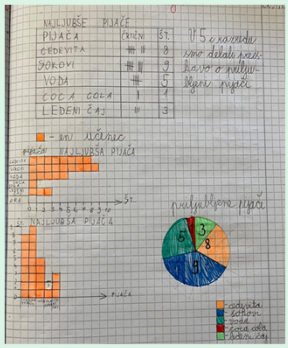
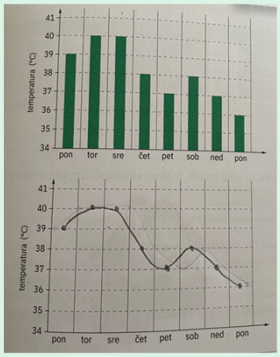


COLLECTED DATA AND FINDINGS

- ✓ I tested the pupils knowledge in various subject in half a year. Knowledge is deepened and adopted.
- ✓ They knew how to justify their conclusions.
- ✓ They developed communication skills during evaluation and reporting.
- ✓ The pupils were motivated at work, as they created the research themselves.

CONCLUSION

I am pleased that the pupils were motivated and independent in their work.
The survey was carried out step by step.
Knowledge is certainly more permanent.

Viri:
Samostojni delovni zvezek za 5. razred osnovne šole, Naše zgodbe 5 Matematika (Nuška Konec, Edita Pašagić)
Samostojni delovni zvezek za 5. razred osnovne šole, Naše zgodbe 5 Slovenščina (Rajko Tekalec, Suzana Boj, Kristina Rupret)
Mathematics curriculum

OSNOVNA ŠOLA LJUDSKI VRT PTUJ
Univerza v Ljubljani Pedagoška fakulteta

INQUIRY OF SOIL

Mateja Kelner
Primary school Ljudski vrt Ptuj

I have carried out my inquiry in the 5th class, at the subject Science and Technology. The average age of the pupils was 10. I conducted the inquiry after the contents about water, air and soil had been learnt. This was the only way they could use the already acquired knowledge in their ihquiry in a new situation. I got an idea for the implementation at the RISE meeting. I observed the students' participation in the groups and the implementation of acquired knowledge in new situations. I monitored their formulation of the inquiry questions and hypotheses, their findings and evaluation of the work and I collected evidence of the work.

1. WHAT I WAS INTERESTED IN

I was interested in the implementation of acquired knowledge in new situations.
I was interested in how they would set the experiment, posed the research question and hypothesis and how they will collaborate.

My research question was how can 10 years pupils design their own research?

I collected data with worksheets and taking pictures.

I observed group dynamics and collaborative learning.

2. PUPILS ACTIVITY

- Research planning,
- setting the hypothesis and research question,
- the actual execution of the experiment,
- reporting.

What are we interested in? What will we research?	Hypothesis:	Assembling
In which soil will the plant grow first?	The plant will grow earlier in the purchased land.	We were right. The soil that we bought has something in it.
Which soil has thicker mud?	We think that number 3 will be the most dense and number 1 will be the least dense.	We were right about no. 3. the water
Will the water be purified in all pots?	We assume that the water will be more purified in some soils than in others	We found out, that the watter was filtered, only the color remained.

What happens if soil is mixed with water and purified through a filter?

Wich soil is the heaviest?

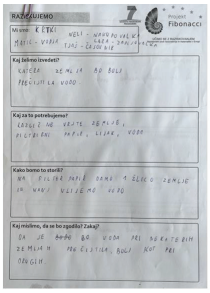
If water and soil separate through filter paper?

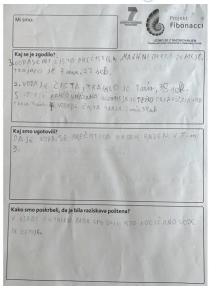
Which soil will purify the water more?

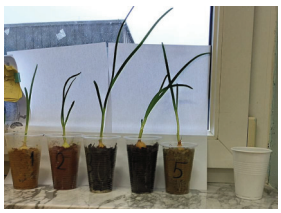
In which soil will the plant grow first?

3. COLLECTED DATA AND FINDINGS

Pupils showed high motivation for work.
I found out that we can bring research lessons to 10-year-olds as well.
Group dynamics and cooperation were excellent.







4. CONCLUSIONS

I realized that the knowledge gained in this way is more permanent.
Researching can also be suitable for a 10-year-old.
This way of working is an enrichment of the lessons.

Viri:
Samostojni delovni zvezek za 5. razred osnovne šole, Naše zgodbe 5 Naravoslovje in tehnika (Irena Demšar, Samo Jamšek, Živa Jamšek, Nina Pucko)
Ana Gostinčar Blagotinšek: Didaktična gradiva projekta Fibonacci – Kako raziskujemo