

inSpiring SCIENCE

education

Supporting the Assessment of Problem Solving Competences through Inquiry-based Teaching in School Science Education: The Inspiring Science Education Tools

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The Inspiring Science project has received funding from the European Union's ICT Policy Support Programme as part of the Competitiveness and Innovation Framework Programme. This publication reflects only the author's views and the European Union is not liable for any use that might be made of information contained therein.

Presentation Outline (1/3)

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 - The need for inquiry based approaches
- Inquiry-based Learning:
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 - Main Phases
 - Cultivation of Problem Solving Competence
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- Assessing Problem Solving Competence:
 - The PISA 2012 Problem Solving Framework (PSF)
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- The need for Tools to Support the Assessment of Problem Solving Competences through Inquiry-based Learning

Presentation Outline (2/3)

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 - The ISE Delivery Tool:
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Part A: School Science Education and Inquiry-based Learning

School Science Education: Why is it important?

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- **Science¹ education** plays a critical role in societies' competitiveness and economic future.
- Science education is essential for students of all backgrounds, talents, interests, and abilities. Understanding how Science is part of our daily lives can give students a great foundation for success in life.
- All students need to cultivate competences that develop their **scientific literacy**, namely: *“the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen”* (OECD, 2015)
- As a result, Science Education is recognized as a **top priority for school education** worldwide, and, thus, a key challenge for technology-supported and technology-enabled school education innovations (Johnson et. al., 2012)

Johnson, L., Adams, S., Cummins, M., and Estrada, V. (2012). *Technology Outlook for STEM+ Education 2012-2017: An NMC Horizon Report Sector Analysis*. Austin, Texas: The New Media Consortium.

OECD. (2013). *PISA 2015 draft science framework*

¹Hereafter, when referring to Science at large, we mean natural Sciences (physics, biology, chemistry, astronomy, geology etc) technology (including computer science) and mathematics also referred to as STEM (Science, Technology, Engineering and Mathematics)

School Science Education: The need for inquiry based approaches

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- Developing **scientific literacy** in compulsory school education requires preparing students in four main strands, namely (Alberts, 2009):
 - To know, use, and interpret scientific explanations of the natural world
 - To generate and evaluate scientific evidence and explanations
 - To understand the nature and development of scientific knowledge
 - To participate productively in scientific practices and discourse
- Thus, there is a clear need for **inquiry based approaches** towards developing students' scientific literacy
- **Inquiry** is the process in which students are engaged in scientifically oriented questions, perform active experimentation, formulate explanations from evidence, evaluate their explanations in light of alternative explanations, and communicate and justify their proposed explanations (National Research Council, 2000)

Alberts, B. (2009). Redefining science education. Science, 323(5913), 437.

National Research Council. (2000). Inquiry and the national science education standards. A guide for teaching and learning. Washington DC: National Academy Press

Inquiry-based Learning: Overview

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- Several studies have demonstrated that **Inquiry-based Learning**:
 - leads to better acquisition of **domain** (conceptual) **knowledge** (Hwang et al., 2013)
 - has a significant positive influence on students' **motivation** (Tuan et al. 2005)
 - leads to increased students' **engagement** (Tsai et al., 2006)
 - has a significant positive influence on students' **attitudes towards science** (Koksal & Berberoglu, 2014)

Hwang, G. J., Wu, P. H., Zhuang, Y. Y., & Huang, Y. M. (2013). Effects of the inquiry-based mobile learning model on the cognitive load and learning achievement of students. *Interactive Learning Environments*, 21(4), 338-354.

Koksal, E. A., & Berberoglu, G. (2014). The Effect of Guided-Inquiry Instruction on 6th Grade Turkish Students' Achievement, Science Process Skills, and Attitudes Toward Science. *International Journal of Science Education*, 36(1), 66-78.

Tsai, C. C., & Tuan, H. L. (2006). Investigating the inquiry-based instruction effects on the 8th graders' perceptions about learning environments in the physical science. In *Hongkong: APERA Conference*.

Tuan, H.L., Chin, C.C., Tsai, C.C., & Cheng, S.F. (2005). Investigating the effectiveness of inquiry instruction of different learning styles students. *International Journal of Science and Mathematics Education*, 3, 541-566.

Inquiry-based Learning: Main Phases (1/2)

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- Inquiry-based learning is often organized into inquiry phases that together form an **inquiry cycle**. However, different variations on what is called the inquiry cycle can be found throughout the literature (Pedaste et al., 2015)
- A widely used inquiry learning model is the **5E Model**, which lists five inquiry phases: **E**ngagement, **E**xploration, **E**xplanation, **E**laboration, and **E**valuation (Bybee et al., 2006).

Pedaste, M., Mäeots, M., Siiman, L. A., de Jong, T., van Riesen, S. A., Kamp, E. T., Manoli, C., Zacharia, Z. & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. Educational Research Review, 14, 47-61.

Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). The BSCS 5E instructional model: Origins and effectiveness. Colorado Springs, CO: BSCS.

Bell, T., Urhahne, D., Schanze, S., & Ploetzner, R. (2010). Collaborative inquiry learning: Models, tools, and challenges. International Journal of Science Education, 32(3), 349-377.

Inquiry-based Learning: Main Phases (2/2)

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- In our work, we have adapted the 5E Model by considering also the inquiry cycle proposed by Bell et al. (2010). More specifically, the following inquiry phases has been adopted:
 - **Orienting & Asking Questions:** This phase involves the presentation of the problem to be engaged with and aims to provoke curiosity.
 - **Hypothesis Generation & Design:** The second phase involves the formulation of initial hypotheses from the students based on their own reason and current understanding of the matter at hand.
 - **Planning & Investigation:** The third phase is related to the collection, analysis and organization of the research/experimentation processes and the related tools/resources that will facilitate these. This can be discovered by the students or provided by the teacher.
 - **Analysis & Interpretation:** During the fourth phase, the learners engage in experimentations following the processes outlined in Phase 3 and utilizing the tools/resources selected in the same Phase.
 - **Conclusion & Evaluation:** The fifth phase includes reflective analysis of the learners initial hypotheses based on the newly acquired knowledge and experience. Moreover, it aims to assist learners in gaining a more holistic view of the problem

Inquiry-based Learning: Cultivation of Problem Solving Competence

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- Several studies have also provided evidence that **Inquiry-based Learning** (Raes et al., 2012; Prince & Felder, 2006):
 - promotes self-regulated learning and meta-cognition
 - develops the cognitive process that cultivates ***problem solving (PS) competence***
- Thus, to be able to measure (among others) the **effectiveness** of inquiry-based learning, assessment of students' problem-solving competences is needed

Raes, A., Schellens, T., De Wever, B., & Vanderhoven, E. (2012). Scaffolding information problem solving in web-based collaborative inquiry learning. Computers & Education, 59(1), 82-94.

Prince, M. J., & Felder, R. M. (2006). Inductive teaching and learning methods: Definitions, comparisons, and research bases. Journal of Engineering Education, 95(2), 123-138

Problem Solving Competence: Why is it important?

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- **Problem solving competence** is a central objective for most compulsory education (K12) curricula and a critical competence for both professional career readiness and effective citizenship (Greiff et al., 2014).
- Problem solving competence is: *“an individual’s capacity to engage in cognitive processing to understand and resolve problem situations where a method of solution is not immediately obvious. It includes the willingness to engage with such situations in order to achieve one’s potential as a constructive and reflective citizen”* (OECD, 2013)
- The acquisition of high levels of problem solving competence provides students the capacity to think critically and creatively in solving complex real-life problems (Lesh & Zawojewski, 2007)
- Yet, both developing and **assessing** problem solving competence as part of School Education remains an open challenge

Greiff, S., Wüstenberg, S., Csapó, B., Demetriou, A., Hautamäki, J., Graesser, A. C., & Martin, R. (2014). Domain-general problem solving skills and education in the 21st century. *Educational Research Review*, 13, 74-83.

Lesh, R. and J.S. Zawojewski (2007), “Problem solving and modeling”, in F. Lester (ed.), *The Handbook of Research on Mathematics Teaching and Learning* (2nd ed.), National Council of Teachers of Mathematics, Reston, Virginia, and Information Age Publishing, Charlotte, North Carolina (joint publication), pp. 763-804.

Organization for Economic Co-operation and Development (OECD) (2013). *PISA 2012 assessment and analytical framework: mathematics, reading, science, problem solving and financial literacy*.

Assessing Problem Solving Competence: The PISA 2012 Problem Solving Framework (PSF) (1/3)

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- A widely accepted framework for assessing individual students' problem solving competence at large scale is **PISA 2012 Problem Solving Framework (PSF)**, which has been developed by the Organization for Economic Co-operation and Development (OECD) to address the need for cross-nationally comparable evidence for student performance on problem solving
- It defines four (4) different steps for solving a complex problem namely (OECD, 2013):

1. Exploring and understanding the problem:

- exploring the problem situation (observing, interacting, searching for information and limitations)
- understanding the given information and the information discovered while interacting with the problem situation.

2. Representing and formulating the problem:

- select relevant information, mentally organize and integrate with relevant prior knowledge.
- shifting between representations or formulating hypotheses by identifying the relevant factors

Organization for Economic Co-operation and Development (OECD) (2013). PISA 2012 assessment and analytical framework: mathematics, reading, science, problem solving and financial literacy.

Assessing Problem Solving Competence: The PISA 2012 Problem Solving Framework (PSF) (2/3)

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3. Planning and executing the strategy for solving the problem

- clarifying the overall goal and setting sub-goals
- devising a plan or strategy to reach the goal state. After that, in the executing phase, the plan will be carried out.

4. Monitoring and reflecting the solution

- monitor the progress towards reaching the goal at each stage including checking intermediate and final results, detecting unexpected events
- reflect on solutions from different perspectives and critically evaluate assumptions and alternative solutions.

Assessing Problem Solving Competence: The PISA 2012 Problem Solving Framework (PSF) (3/3)

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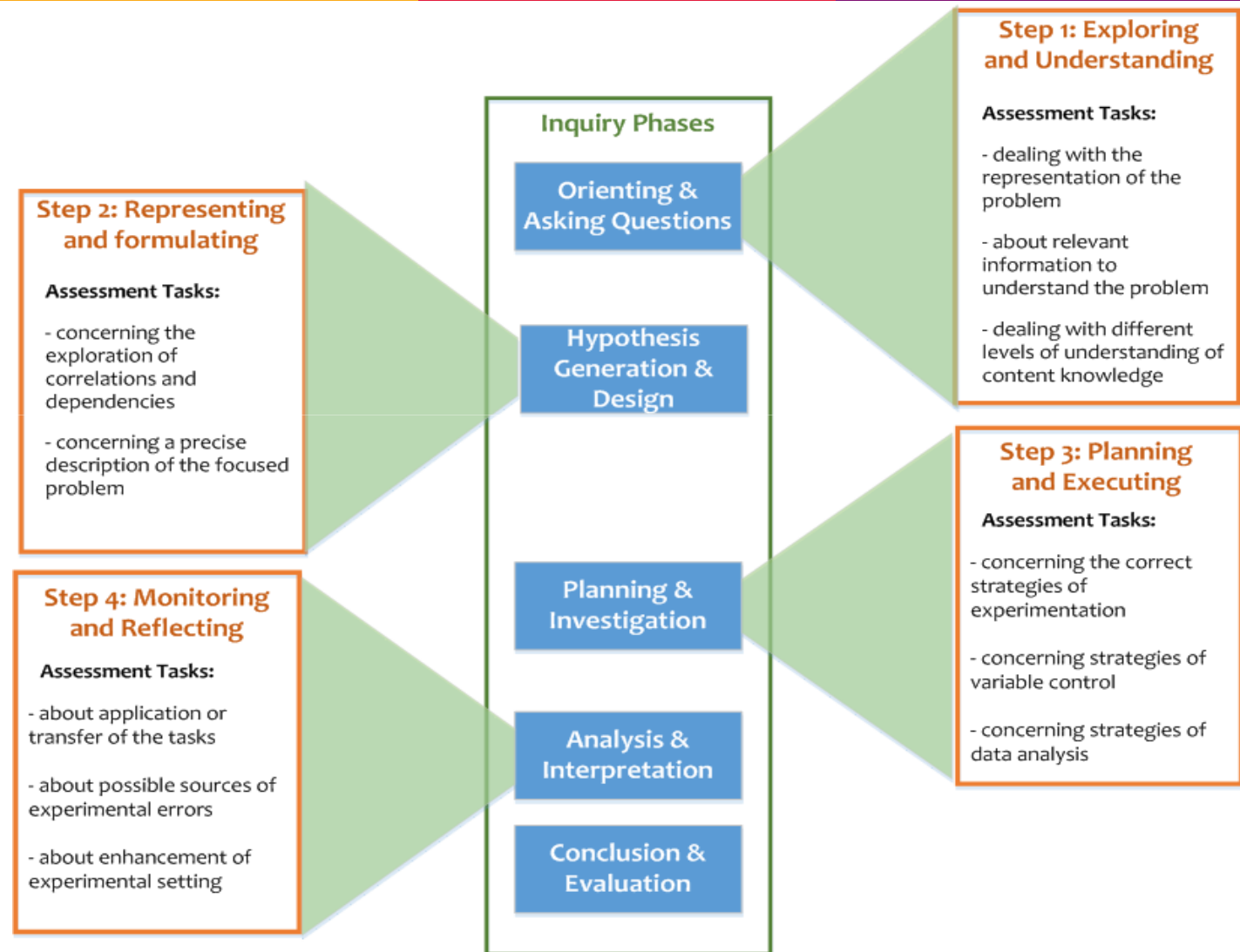
- The range of problem solving assessment tasks included in the PISA 2012 PSF allows for describing six levels of problem solving proficiency that can be grouped into three main categories, namely (OECD, 2014):
 - **High Performers (Level 6 and Level 5)** - students at this category can:
 - develop complete, coherent mental models of different situations
 - can find an answer through target exploration and a methodical execution of multi-step plans
 - **Moderate Performers (Level 4 and Level 3)** - students at this category can:
 - control moderately complex devices, but not always efficiently
 - handle multiple conditions or inter-related features by controlling the variables
 - **Low Performers (Level 2 and Level 1)** - student at this category can:
 - answer if a single, specific constrain has to be taken into account
 - partially describe the behavior of a simple, everyday topic.

OECD (2014). *PISA 2012 Results: Creative Problem Solving: Students' Skills in Tackling Real-Life Problems (Volume V)*. PISA, OECD Publishing

Assessing Problem Solving Competence: Incorporating PISA 2012 PSF in Inquiry Cycle

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- How the cognitive process of problem solving can be assessed in the different phases of the Inquiry Cycle??



The Need for Tools to Support the Assessment of Problem Solving Competences through Inquiry-based Learning

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- PISA 2012 problem solving competence assessment is **summative** (one-off assessment) and ***disconnected from the school practice***.
- There is lack of evidence to connect ***students' performance on problem solving competence*** to the ***specific design considerations*** of lesson plans and their teaching and learning activities.
- This shortcoming can hinder science ***teachers' capacity to reflect*** on and accordingly ***adapt their lesson plans*** towards enhancing students' performance on problem solving competence.

The Need for Tools to Support the Assessment of Problem Solving Competences through Inquiry-based Learning

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- Thus, we need **tools** to support teachers to:
 - **Author** technology-enhanced science education lessons that follow the inquiry cycle (as proposed in slide #10) and by incorporating appropriate (PISA 2012 PSF compatible) assessment tasks (as proposed in slide #16)
 - **Deliver** technology-enhanced science education lessons with their students to **collect assessment data** (PISA 2012 PSF compatible) and monitor their students' problem solving competences, as well as reflect on and accordingly adapt their lesson plans for future delivery

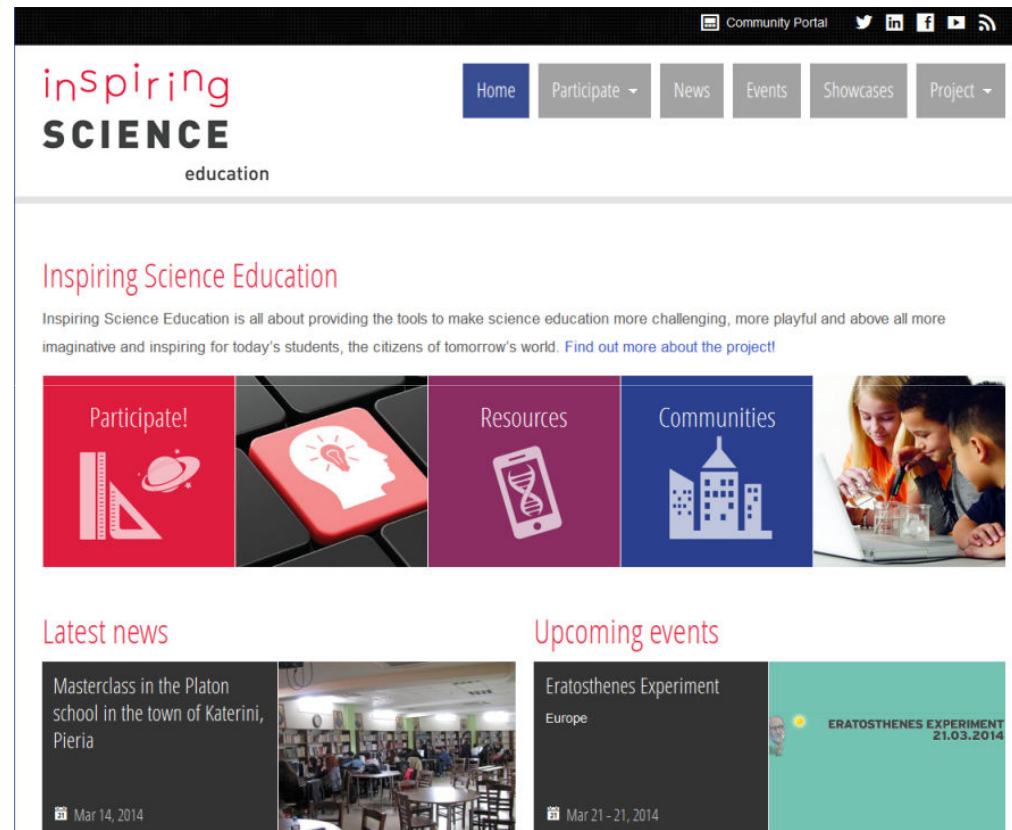
Part B: The Inspiring Science Education Tools

The Inspiring Science Education Project

<http://www.inspiring-science.eu/>

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- Funded by European Commission's CIP-ICT Policy Support Programme
- 40 Months Project (started on 1/4/2013, ends on 31/7/2016)
- Expected to engage **5.000 schools**, **10.000 teachers** and **50.000 students**
- It has developed the technical infrastructure for designing and delivering technology enhanced science lessons:
 - following the inquiry cycle (as presented in slide #10)
 - incorporating the PISA 2012 PSF embedded in the various phases of the inquiry cycle (as presented in slide #16)



The ISE Portal: Overview

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- The ISE Authoring and Delivery Tool have been developed and integrated to the ISE Portal (<http://portal.opendiscoveryspace.eu/ise>)
- A web-based infrastructure for European School Teachers for having access to:
 - a wide number of Digital Educational Resources from a federated network of repositories
 - a set of digital tools for science education from an appropriately designed repository of tools
 - Online teachers' communities and accompanying community tools such as forums, wikis and blogs
- Join here: <http://portal.opendiscoveryspace.eu/ise>

The screenshot shows the Inspiring Science Education portal. The header features the logo 'inspiring SCIENCE education' and a user profile 'Panagiotis Zervas' with a 'Logout' link. A navigation bar includes links for 'RESOURCES', 'DIGITAL TOOLS REPOSITORY', 'COMMUNITIES', 'SCHOOLS', 'PEOPLE', and 'ACADEMIES'. The main content area has a large banner for 'Electromagnetic Spectrum - Wednesday, 22 April 2015 17.00 UK / 18.00 CET' with a 'read more +' link. To the left, there are social media widgets for Twitter and Facebook. To the right, a sidebar titled 'iS_e LEARN ABOUT ISE' provides a brief description of the project's mission. At the bottom, a 'Find out more About' section is followed by three statistics boxes: '98 TEACHER COMMUNITIES', '4461 CONNECTED TEACHERS', and '193754 TOTAL RESOURCES AVAILABLE'.

COMMUNITIES	PEOPLE	RESOURCES
Top Communities	Top Contributors	Featured Resources
98 TEACHER COMMUNITIES	4461 CONNECTED TEACHERS	193754 TOTAL RESOURCES AVAILABLE

The ISE Portal: How to access the ISE Authoring Tool?

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The screenshot displays the Inspiring Science Education portal interface. At the top, the logo "inspiring SCIENCE education" is visible, along with navigation links for "About Us" and a language menu. The language menu includes options: English, Nederlands, Français, Deutsch, Ελληνικά, Italiano, Español, Български, Portuguese, and Română. Below the header, a navigation bar contains buttons for "Resources", "Digital Tools Repository", "Communities", "Schools", "People", and "Academies". A breadcrumb trail shows the path: Home | The Inspiring Science Education Tools: Webinars | Community Resources. The main content area features two primary actions: "Search educational resources of the Community" and "Create new educational resources in the Community". The "Create new" section is divided into three steps: Step 1 (Select Type of Resource) with options for Educational Object, Lesson Plan (selected), and Educational Scenario; Step 2 (Select Tool) with options for ISE Authoring Tool (selected) and UDLnet Inventory; and Step 3, which includes a "Create New" button. A callout box points to the "Create New" button with the instruction: "3. Press 'Create New'".

Community URL: <http://portal.opendiscoveryspace.eu/community/inspiring-science-education-tools-webinars-829029>

The ISE Authoring Tool: Design Considerations (A-DCs)

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- **A-DC1:** Teachers should be able to develop technology-enhanced science education lessons following the inquiry cycle (as presented in slide #10).
- **A-DC2:** Each phase of the inquiry cycle includes a set of inquiry activities. Each inquiry activity should include:
 - **A-DC2.1:** Digital educational resources of any type (text, images, videos)
 - **A-DC2.2 :** External digital educational resources stored in the ISE Portal
 - **A-DC2.3:** External digital educational tools stored in the ISE Tools Repository
 - **A-DC2.4:** Guidelines/notes for the teacher to implement the inquiry activity
 - **A-DC2.5:** Assessment tasks to assess students' knowledge and provide feedback
- **A-DC3:** Teachers should be able to add at the end of each inquiry phase appropriately designed assessment tasks, so as the cognitive process of problem solving to be assessed (as presented in slide #16)
- **A-DC4:** Teachers should be able to store with educational metadata their technology-enhanced science education lessons to the ISE Portal, so as to be searchable from other teachers
- **A-DC5:** Teachers should be able to clone and adapt technology-enhanced science education lessons developed by other teachers. This means that teachers should be able to both copy an existing technology-enhanced science education lesson developed by another teacher (clone) and based on this, incorporate potential changes for addressing their needs (adapt)

The ISE Authoring Tool: Implementing A-DC1 - Develop an Inquiry lesson

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inspiring **SCIENCE** education

My Lessons and Scenarios Lessons and Scenarios from other authors My Last edited Lesson pzervas

Foucault's pendulum

Inquiry Lesson Title

Orienting & Asking Questions Hypothesis Generation & Design Planning & Investigation Analysis & Interpretation Conclusion & Evaluation

+ Add Sub-activity

Provoke Curiosity Offline

The process of inquiry can be focused on **answering a question**, but also on other goals, such as investigating a controversial dilemma

- classroom discussion and support it, for example, with
- narratives,
- videos, or
- simulations.

The students can take notes, ask questions, and discuss the contents.

Παρατηρήστε τις παρακάτω εικόνες. Τι κοινό έχουν;



Σημείωσε την απάντησή σου στη πρώτη από τις ερωτήσεις που θα βρεις στο τέλος της σελίδας.

Save Lesson

Inquiry Phases following the inquiry cycle presented in slide #10

Guidelines for authoring the inquiry activities

The ISE Authoring Tool: Implementing A-DC2.1 - Develop an Inquiry Activity – Add Educational Resources

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The screenshot displays the ISE Authoring Tool interface. At the top, there is a Rich Text Editor with a toolbar containing icons for text formatting (bold, italic, underline, strikethrough, subscript, superscript), alignment, and other editing functions. Below the toolbar, the text "Παρατηρήστε τις παρακάτω εικόνες. Τι κοινό έχουν;" is visible. To the left of the video embed section, there is a large image of a solar eclipse. Below this image, the text "Σημείωσε την απάντησή σου στη τ" is visible. The video embed section is titled "video You can embed your videos" and contains a text input field for a YouTube Video URL, which currently contains "https://www.youtube.com/watch?v=-PhjA6nstvU". To the right of the URL field is an "Embed" button. Below the URL field, there are four video preview thumbnails. The first thumbnail is titled "The Solar Eclipse" and features the BBC News logo. The other three thumbnails show a person using a telescope. A callout box labeled "YouTube Video Preview" points to these thumbnails.

Rich Text Editor

YouTube Video URL

YouTube Video Preview

The ISE Authoring Tool: Implementing A-DC2.2 - Develop an Inquiry Activity – Add External Educational Resources

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Search ODS

You can search for educational resources in ODS repository.

 solar

Solar technology for everyone. An interview with Rainer Hoefer, CEO of the Sonnenkraft GmbH, Regensburg

Date 2015-02-03

Description: oai:oaicat.iconda.org:2008081004737 solar energy installation use of solar energy Solar energy solar heat collector collector Photovoltaics solar collector possibility of application interview View resource Rainer Hoefer Monday, January 1, 2007- 01:00 Educational Object MACE Yes text

Need to catch up on PV monitoring. Regular assessment of installation data, whether manual or automated- protect against loss of yield and returns

Date 2015-02-03

Description: oai:oaicat.iconda.org:2008091002159 use of solar energy Solar energy solar heat collector collector solar energy installation upkeep supervision Photovoltaics solar collector usage of regenerative energy View resource Ina Roepcke Tuesday, January 1, 2008- 01:00 Educational Object MACE Yes text

The ISE Authoring Tool: Implementing A-DC2.3 - Develop an Inquiry Activity – Add External Educational Tools

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Search for e-Learning Tools

You can search for e-Learning tools in the ISE tools repository.

 type your search term here... Search term(s) Search →

Language: Greek Inquiry Cycle Phase Supported: Orienting & Asking Questions Tool Type: Any Mobile Devices: Any

Big Ideas of Science: × 3. Changing the movement of an object requires a net force to be acting on it.

Subject Domain: × Environmental education × Physics Age Group(s): × Any

HY.P.A.T.I.A.   Add the external tool to the inquiry activity

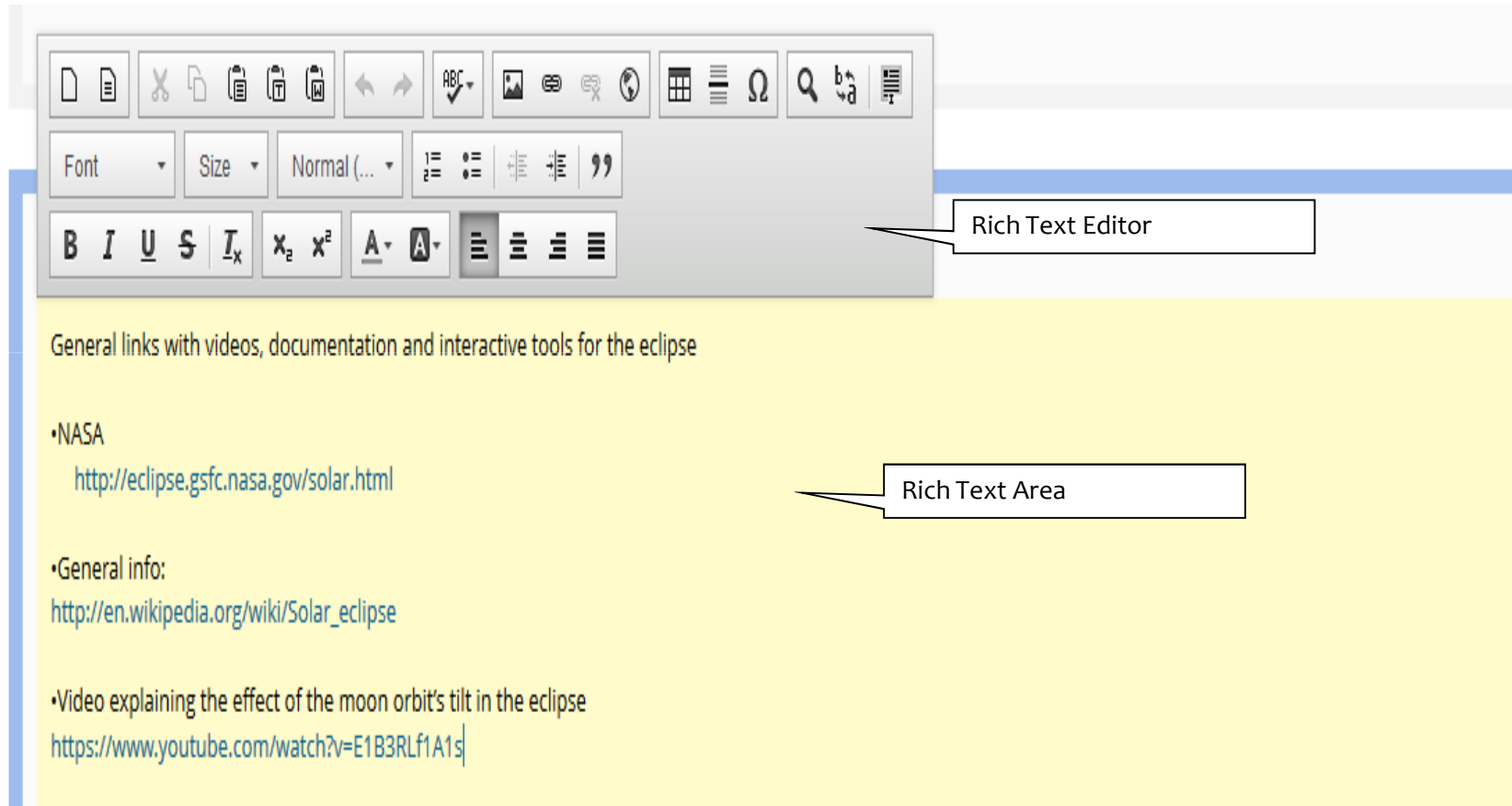
Description: HY.P.A.T.I.A. aims to show students how real high energy physic research is done. It provides the students with real data and an environment that closely resembles what actual researchers use, to give them the opportunity to conduct their own analysis and “discover” new results. It is a tool for data collected by the ATLAS experiment of the LHC at CERN. Its goal is to allow high school and university students to explore the complexity of the hadron – hadron interactions through the graphical representation of ATLAS event data and interact with them in order to study different aspects of the fundamental building blocks of nature.

Analysis Tool

First Previous 1 Next Last

The ISE Authoring Tool: Implementing A-DC2.4 - Develop an Inquiry Activity – Add Teacher Notes/Guidelines

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The screenshot displays the ISE Authoring Tool interface. At the top, there is a toolbar with various icons for text formatting, alignment, and insertion. Below the toolbar, there is a text area with a yellow background. The text area contains the following content:

General links with videos, documentation and interactive tools for the eclipse

- NASA
<http://eclipse.gsfc.nasa.gov/solar.html>
- General info:
http://en.wikipedia.org/wiki/Solar_eclipse
- Video explaining the effect of the moon orbit's tilt in the eclipse
<https://www.youtube.com/watch?v=E1B3RLf1A1s>

Two callout boxes are present: one labeled "Rich Text Editor" pointing to the toolbar, and another labeled "Rich Text Area" pointing to the text area.

The ISE Authoring Tool: Implementing A-DC2.4 - Develop an Inquiry Activity – Add Knowledge Assessment Tasks

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Formative assessment question

1.What is the shape of earth's and moon's orbit?

Question area

Possible answer 1

Both circular

Possible Answers

Student feedback for answer 1

You can type the feedback here...

Possible answer 2

Both elliptical

Student feedback for answer 2

You can type the feedback here...

Feedback to be presented per answer selected

Possible answer 3

Earth elliptical and moon circular

Student feedback for answer 3

You can type the feedback here...

Possible answer 4

Earth circular and moon elliptical

Student feedback for answer 4

You can type the feedback here...

The ISE Authoring Tool: Implementing A-DC₃ - Assess Problem Solving Process

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PISA Assessment: Exploring and Understanding

Question: 1

Encourage your students to describe the observed phenomenon. They should also pay attention to ancillary conditions.

Τι κοινό έχουν οι παραπάνω εικόνες;

Question area

Possible answer 1 for the High performer

Δείχνουν όλες κινήσεις που ως παρατηρητές αντιλαμβανόμαστε την αντίστοιχη κίνηση των αντικειμένων πραγματικά.

Possible Answers

Possible answer 2 for the Moderate performer

Αφορούν όλες περιοδικά φαινόμενα.

Connection with PISA 2012 Proficiency Levels of Problem Solving Framework

Possible answer 3 for the Low performer

Δείχνουν και οι δυο κυκλική κίνηση ουρανίων σωμάτων.

- At the end of each inquiry phase, two questions are added to assess the problem solving process

The ISE Authoring Tool: Implementing A-DC4 - Store Lesson to the ISE Portal – Add Metadata

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- Step 1: General Info
- Step 2: Educational Context
- Step 3: Educational Objectives
- Step 4: Subject Domain
- Step 5: Additional Information

The screenshot shows the 'inspiring SCIENCE education' logo at the top left. Navigation links include 'My Lessons and Scenarios', 'Lessons and Scenarios from other authors', and 'My Last edited Lesson'. A progress bar at the top indicates five steps: 1. General Info (active), 2. Educational Context, 3. Educational objective(s), 4. Subject Domain, and 5. Additional Information. A callout box labeled 'Steps of the wizard' points to this progress bar.

The 'General Info' section contains the following fields:

- Title ***: Text input with 'Foucault's pendulum'. Below it is the label 'Provide Title'.
- Short Description ***: Text area with 'Students will observe the movement of Foucault's pendulum in order to witness the Earth's rotation.' Below it is the label 'Provide short description'.
- Keyword(s)**: Tag input with 'pendulum' and 'angular velocity'. Below it is the label 'Provide Keyword(s)'.
- Language ***: Dropdown menu with 'Greek' selected. Below it is the label 'Provide language'.
- License Level ***: Dropdown menu with 'Public, Allowing adaptations' selected. Below it is the label 'Provide License Level'.

A callout box labeled 'Metadata Fields' points to the Keyword(s), Language, and License Level fields.

At the bottom of the form is a blue 'Continue' button with a right arrow icon.

The ISE Authoring Tool: Implementing A-DC4 - Store Lesson to the ISE Portal – Publish Lesson

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Foucault's pendulum



Date Created: 16/12/2014 - 15:53

Set status to Final

Short description: Students will observe the movement of Foucault's pendulum in order to witness the Earth's rotation.

Current status: Draft

Access rights: Public, Allowing adaptations

Age range(s): 12-14, 14-16, 16-18

Home | ISE Authoring Tool Webinar | [Community Resources](#)

Search educational resources of the Community

Create new educational resources in the Community

Search by title:

Type:

Community:



- Any -

- Any -

Search

Clear

Sort by: Most Recent

Hide Filters

1 - 3 out of 3 resources

Energy and Electricity

Mon, 03/02/2015 - 15:32

Repository: ISE | [ISE Authoring Tool Webinar](#)

Contributor: [Redacted]

The script is designed to introduce students to the skills of argumentation, dialogue and constructive confrontation. In addition there is an effort to strengthen the skills of initiative, to troubleshoot a problem, development and implementation of ideas, culture and creative writing of spoken and...

Foucault's pendulum

Fri, 03/13/2015 - 16:34

Repository: ISE | [ISE Authoring](#)

Contributor: [Panagiotis Zervas](#)

Students will observe the movement of Foucault's pendulum in order to witness the Earth's rotation.

Inquiry Lesson at ISE Portal Community

The ISE Authoring Tool: Implementing A-DC5 - Search Lessons from other Teachers – Clone and Adapt

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The screenshot displays the Inspiring Science Authoring Tool interface. The top navigation bar includes the logo and links for 'My Lessons and Scenarios', 'Lessons and Scenarios from other authors', and 'My Last edited Lesson'. The main content area is titled 'Summary Page - Digging Into Comets' and is divided into two columns. The left column, labeled 'General Info', contains fields for Title, Date Created, Short Description, Current status, Author, Original Author, Keyword(s), Language, and License Level. The right column, labeled 'Lesson Metadata', contains fields for Title, Date Created, Short Description, Current status, Author, Original Author, Keyword(s), Language, and License Level. A callout box points to the 'Short Description' field in the 'General Info' column, which contains the text 'Eratosthenes Experiment...'. Another callout box points to the 'Short Description' field in the 'Lesson Metadata' column, which contains the text 'Adapt Lesson's Inquiry Phases'. The bottom of the interface shows a video player with a play button and a 'Continue' button.

inspiring SCIENCE education

My Lessons and Scenarios Lessons and Scenarios from other authors My Last edited Lesson

Lessons and Education

Create, Edit Search.

Lessons and Education

1

Eratosthenes Experiment...

Date Created: 27/02/2015 - 18:24

Short description: Οι μαθητές...

Current status: Delivered

Age range(s): 8-10, 10-12

Access rights: Public, Allowing...

Author: Legenia Hypothesis

Original Author: Legenia Hypothesis

Summary Page - Digging Into Comets

General Info

Lesson Metadata

Edit Lesson Metadata

Add Sub-activity

Generation of Hypotheses or preliminary explanations Offline

Together with students' prior knowledge and the notes they have taken, the structure of the question/problem/goal forms the basis for **formulating hypotheses**, which can be considered as supposed relations.

- Learners build up hypotheses based on question or problem
- Learners can be supported by classmates, software or the teacher
- If questions are open-ended hypotheses can't be tested but their plausibility can be scientifically justified

The hypotheses can be written down as well to test them afterwards.

Ακολουθώντας τις ιδέες που συζητήσαμε παραπάνω, μπορείτε να προτείνετε μία μέθοδο για να μετρηθεί η περιφέρεια της γης:

Ας δούμε πως τό 'κανε ο Ερατοσθένης!

Adapt Lesson's Inquiry Phases

How simple ideas lead to scientific discoveries - Adam Savage

Continue

The ISE Delivery Tool: Design Considerations (D-DCs)

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- **D-DC1:** Teachers and Students should be able to access the ISE Delivery Tool through unique web links produced by the ISE Authoring Tool for each lesson to be delivered
- **D-DC2:** Students should be able to enroll (considering data privacy issues) in science education lessons and execute the different phases in a fixed order, or “lockstep” fashion. The lockstep procedure means that students will not be able to answer again the problem solving questions at the end of any inquiry phase when moved to the next one (OECD, 2013).
- **D-DC3:** Students should be able to see at the end of the lesson, data about their performance, as well as how their performance is compared with the overall class performance.
- **D-DC4:** Teachers should be able to enroll in science education lessons along with their students and they should be able to see an augmented view of the lesson including: (a) notes/guidelines about how to execute specific inquiry activities and (b) the correct answers to problem solving and knowledge questions
- **D-DC5:** Teachers should be able to monitor (a) the students enrolled in their science education lessons (DC5.1), (b) students’ performance on problem solving competence assessment (DC5.2), (c) students’ performance on knowledge assessment (DC5.3) and (d) students’ time spent per inquiry phase (DC5.4)
- **D-DC6:** Teachers should be able to pause and re-start a lesson at a later time
- **D-DC7:** Teachers and students should be able to access a science education lesson with different devices (desktop or mobile devices) (DC7.1) and personalize the interface according to their accessibility preferences (DC7.2)

Organization for Economic Co-operation and Development (OECD) (2013). PISA 2012 assessment and analytical framework: mathematics, reading, science, problem solving and financial literacy.

The ISE Delivery Tool: Implementing D-DC1 - How to Access the ISE Delivery Tool? – 1/2

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Foucault's pendulum        

Date Created: 16/12/2014 - 15:53

Deliver Lesson

Short description: Students will observe the movement of Foucault's pendulum in order to witness the Earth's rotation.

Current status: Final

Access rights: Public, Allowing adaptations

Age range(s): 12-14, 14-16, 16-18

Delivered Lessons and Scenarios teacher and class links.

Foucault's pendulum

Showing 1 to 5 of 17 entries

Created Date	Teacher	Class
12/16/14 5:28:10 PM	Teacher Link http://tools.inspiringscience.eu/delivery/lesson/index?id=33cdf366&t=t&username=pzervas&email=pzervas@iti.gr	Class Link http://tools.inspiringscience.eu/delivery/lesson/index?id=7b67a614&t=s

Link for the Teacher

Link for the Students

The ISE Delivery Tool: Implementing D-DC1 - How to Access the ISE Delivery Tool?– 2/2

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The Teacher Login Page features a light gray grid background. At the top, the logo 'iS_e' is displayed in red and black, followed by the text 'WELCOME to another amazing lesson!'. Below this, a white box contains the lesson title 'TITLE OF LESSON , FOUCAULT'S PENDULUM' in green. A description follows: 'Students will observe the movement of Foucault's pendulum in order to witness the Earth's rotation.' There are two input fields: 'ENTER YOUR NICKNAME' and 'ENTER YOUR EMAIL'. An orange 'START LESSON' button is at the bottom right. Decorative elements include a magnifying glass, a globe, a red pen, a beaker, and a green arrow pointing up with 'A+' written next to it.

Teacher Login Page



The Student Login Page has the same layout as the Teacher Login Page but includes an additional input field: 'ENTER PASSPHRASE' below the email field. The decorative elements are identical, including the magnifying glass, globe, red pen, beaker, and green arrow with 'A+'.

Student Login Page

The ISE Delivery Tool: Implementing D-DC2 - Student Enrolment and Execution

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The screenshot shows the ISE Delivery Tool interface for the 'FOUCAULT'S PENDULUM' activity. The top navigation bar includes the 'iS_e' logo, a 'Γεια πανος!' (Hello Panos!) greeting, and icons for 'ASSESSMENT', 'ΡΥΘΜΙΣΕΙΣ' (Settings), and 'ΒΟΗΘΕΙΑ' (Help). Below the navigation bar, the activity title 'FOUCAULT'S PENDULUM' is displayed, followed by a progress bar with five phases: 'ORIENTING & ASKING QUESTIONS', 'HYPOTHESIS GENERATION & DESIGN', 'PLANNING & INVESTIGATION', 'ANALYSIS & INTERPRETATION', and 'CONCLUSION & EVALUATION'. A callout box labeled 'Inquiry Phases' points to this progress bar. The main content area features a 'Provoke Curiosity' section with a text prompt: 'Διάλεξε μια περιοχή και θέσε το εκκρεμές σε κίνηση. Τι παρατηρείς? Απάντησε με βάση τη παρατήρησή σου την πρώτη ερώτηση στο τέλος της σελίδας.' (Choose a region and set the pendulum in motion. What do you observe? Answer based on your observation the first question at the end of the page). Below the prompt is a video player showing a pendulum. A callout box labeled 'Knowledge assessment question' points to a question: 'Η παρατήρησή σου οφείλεται στο γεγονός ότι:' (Your observation is due to the fact that:). The question has five radio button options. The second option, 'Η Γη περιστρέφεται ενώ το εκκρεμές όχι.' (The Earth rotates while the pendulum does not), is selected and highlighted with an orange border. A callout box labeled 'Feedback presented to the student when he/she replies' points to the feedback text: 'Σωστά. Η περιστροφή της Γης δεν επηρεάζει τη κίνηση του εκκρεμούς συνεπώς η κίνηση του εκκρεμούς δεν περι...' (Correct. The rotation of the Earth does not affect the motion of the pendulum, therefore the motion of the pendulum does not depend...). The bottom of the interface shows a 'Σημεία' (Points) section.

iS_e Γεια πανος! ASSESSMENT ΡΥΘΜΙΣΕΙΣ ΒΟΗΘΕΙΑ

FOUCAULT'S PENDULUM

ORIENTING & ASKING QUESTIONS HYPOTHESIS GENERATION & DESIGN PLANNING & INVESTIGATION ANALYSIS & INTERPRETATION CONCLUSION & EVALUATION

Inquiry Phases

ΑΚΟΥΣΤΕ ΤΟ ΠΕΡΙΕΧΟΜΕΝΟ

Provoke Curiosity

Διάλεξε μια περιοχή και θέσε το εκκρεμές σε κίνηση. Τι παρατηρείς? Απάντησε με βάση τη παρατήρησή σου την πρώτη ερώτηση στο τέλος της σελίδας.

Παρατι...

Η παρατήρησή σου οφείλεται στο γεγονός ότι:

Knowledge assessment question

☐ Το εκκρεμές λόγω αδράνειας περιστρέφεται με διαφορετική ταχύτητα σε σχέση με τη Γη.

Επηρεάζει η κίνηση της Γης τη κίνηση του εκκρεμούς;

☒ Η Γη περιστρέφεται ενώ το εκκρεμές όχι.

Feedback presented to the student when he/she replies

Σωστά. Η περιστροφή της Γης δεν επηρεάζει τη κίνηση του εκκρεμούς συνεπώς η κίνηση του εκκρεμούς δεν περι...

☐ Λόγω της κίνησης της Γης αλλάζει το μέτρο της συνιστώσας της βαρύτητας που επηρεάζει τη κίνηση.

Από τι εξαρτάται η δύναμη της βαρύτητας πάνω στη Γη; Επηρεάζει αυτό τη κίνηση του εκκρεμούς;

☐ Η περιστροφή της Γης αναγκάζει το εκκρεμές να περιστραφεί πως την αντίθετη κατεύθυνση.

Επηρεάζει η κίνηση της Γης τη κίνηση του εκκρεμούς;

Σημεία

The ISE Delivery Tool: Implementing D-DC2 - Student Assessment of Problem Solving Competence

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Finish the current section by answering some questions!

Problem Solving
Question

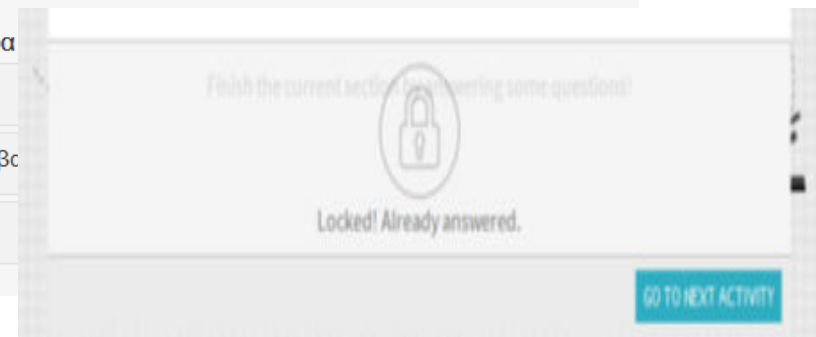
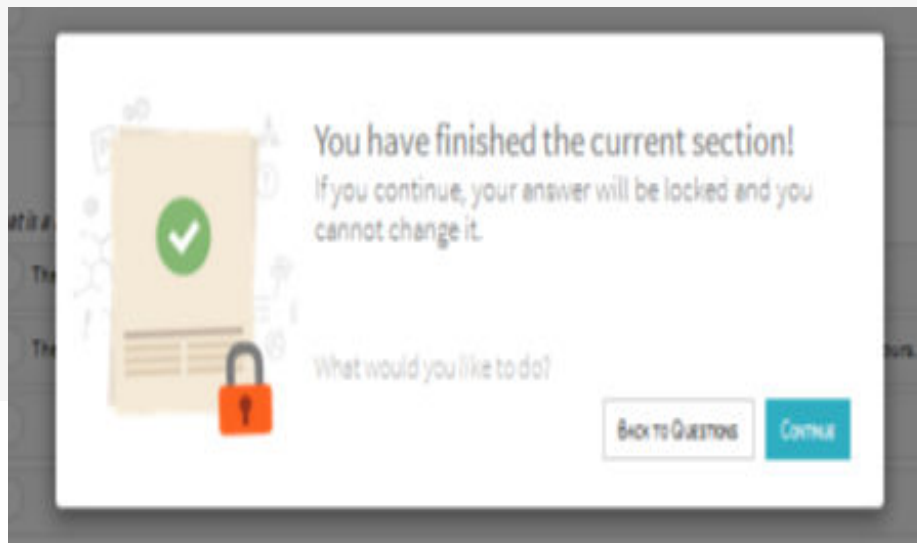
ΑΚΟΥΣΤΕ ΤΗΝ ΕΡΩΤΗΣΗ

Τι κοινό έχουν οι παραπάνω εικόνες;

- ☐ Δείχνουν όλες κινήσεις που ως παρατηρητές αντιλαμβανόμαστε την αντίστροφη κίνηση από αυτή που συμβαίνει πραγματικά.
- ☐ Αφορούν όλες περιοδικά φαινόμενα.
- ☐ Δείχνουν και οι δυο κυκλική κίνηση ουρανίων σωμάτων.

Answers assigned to
the different
proficiency levels of
PISA 2012 Problem
Solving Framework

ΑΚΟΥΣΤΕ ΤΗΝ ΕΡΩΤΗΣΗ



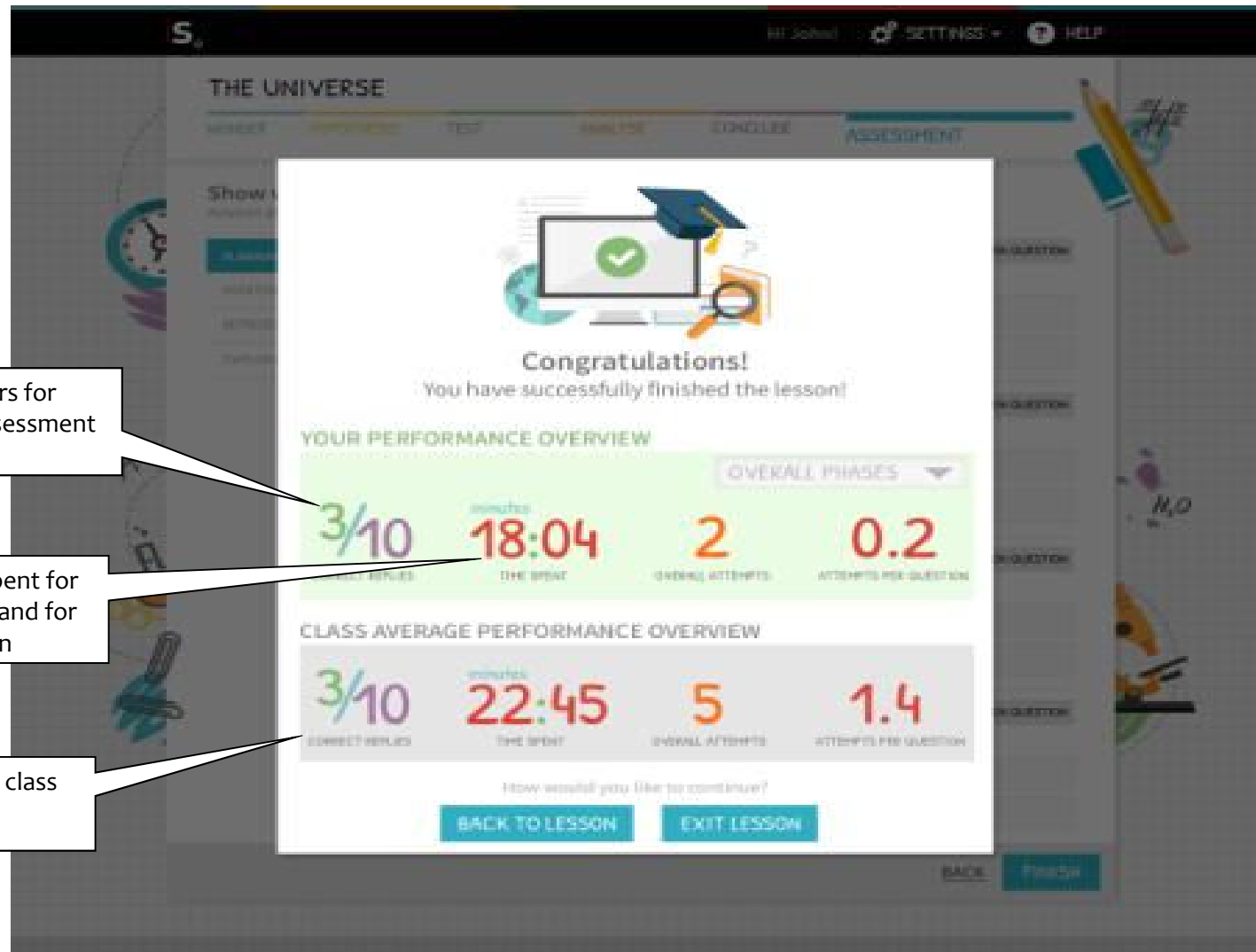
The ISE Delivery Tool: Implementing D-DC₃ - Student Performance

38

Correct answers for knowledge assessment questions

Average time spent for the each phase and for the whole lesson

Comparison with class performance



The ISE Delivery Tool: Implementing D-DC4 - Teacher Enrolment (Augmented View)

39

The screenshot displays the ISE Delivery Tool interface. At the top, a black navigation bar contains the 'iS_e' logo, 'Hi TEST!', 'ASSESSMENT', 'SETTINGS', and 'HELP' icons. Below this, a sidebar on the left lists 'STAR IN A BOX' and 'ORIENTING & ASKING QUESTIONS'. The main content area is titled 'Finish the current section by answering some questions!'. It features two question sections, each with a 'LISTEN QUESTION' button. The first question is 'How do stars vary as seen in the sky?' with three radio button options: '[MODERATE] Stars come in a range of brightnesses and colours, with hotter stars', '[LOW] Stars vary in brightness', and '[HIGH] Cooler stars appear redder than hotter stars, while the apparent brightness of a star varies as its distance from Earth'. The second question is 'How can we measure the properties of stars?' with three radio button options: '[LOW] We can look at stars to see their brightness and colour', '[MODERATE] The brightness and distance of a star tell us its intrinsic luminosity, while its colour tells us how hot its surface is.', and '[HIGH] Only the luminosity and colour of stars are easily observable. Other properties depend on theoretical models of stars.' A text box on the right side of the first question section states: 'Mapping of the answers to the different proficiency levels of PISA 2012 Problem Solving Framework is revealed to the Teacher'. At the bottom, a footer section contains a Stellarium logo and text: 'Stellarium is free software which can be downloaded from the Stellarium.org website. The latest version may not work on some older computers, so if the display doesn't work try downloading version 12.4. If you have problems, please contact your National Coordinator.' A text box on the right side of the footer section states: 'Teacher Notes to execute the Inquiry Activity'.

Hi TEST! ASSESSMENT SETTINGS HELP

STAR IN A BOX

ORIENTING & ASKING QUESTIONS

Finish the current section by answering some questions!

LISTEN QUESTION

How do stars vary as seen in the sky?

☐ [MODERATE] Stars come in a range of brightnesses and colours, with hotter stars

☐ [LOW] Stars vary in brightness

☐ [HIGH] Cooler stars appear redder than hotter stars, while the apparent brightness of a star varies as its distance from Earth

Mapping of the answers to the different proficiency levels of PISA 2012 Problem Solving Framework is revealed to the Teacher

LISTEN QUESTION

How can we measure the properties of stars?

☐ [LOW] We can look at stars to see their brightness and colour

☐ [MODERATE] The brightness and distance of a star tell us its intrinsic luminosity, while its colour tells us how hot its surface is.

☐ [HIGH] Only the luminosity and colour of stars are easily observable. Other properties depend on theoretical models of stars.

Stellarium is free software which can be downloaded from the Stellarium.org website. The latest version may not work on some older computers, so if the display doesn't work try downloading version 12.4. If you have problems, please contact your National Coordinator.

Teacher Notes to execute the Inquiry Activity

The ISE Delivery Tool: Implementing D-DC5.1 - Students' Monitoring – 1/4

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Γεια πανος!
 ASSESSMENT
  PYΘΜΙΣΕΙΣ
  ΒΟΗΘΕΙΑ

PISA CLASS REAL TIME STATISTICS
 PISA ASSESSMENT RESULTS
 FORMATIVE ASSESSMENT RESULTS
 CLASS AVERAGE TIME PER PHASE

NUMBER OF STUDENTS PARTICIPATED IN THE LESSON: 11
 NUMBER OF STUDENTS ANSWERED ALL PISA QUESTIONS: 11

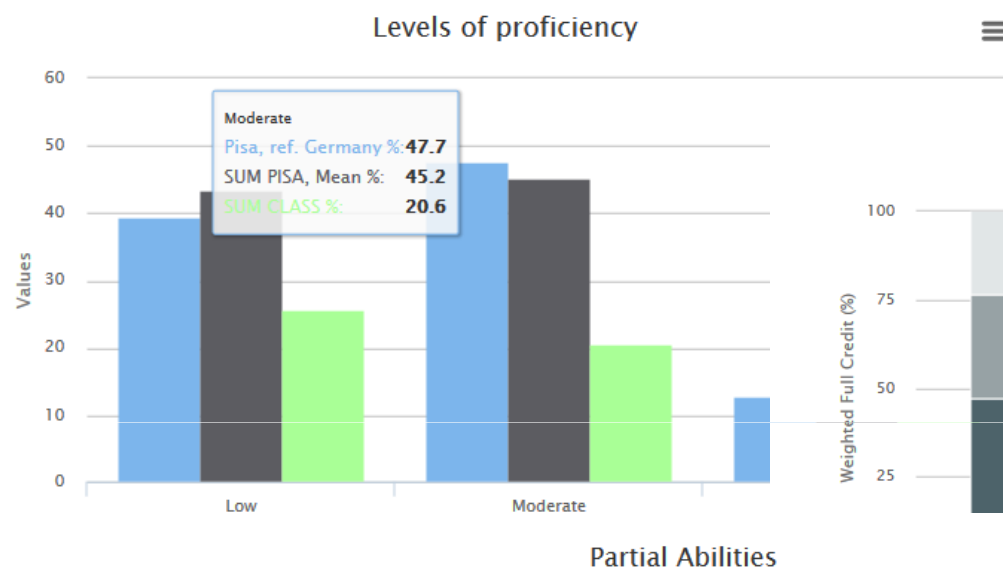
REFRESH

EXPORT

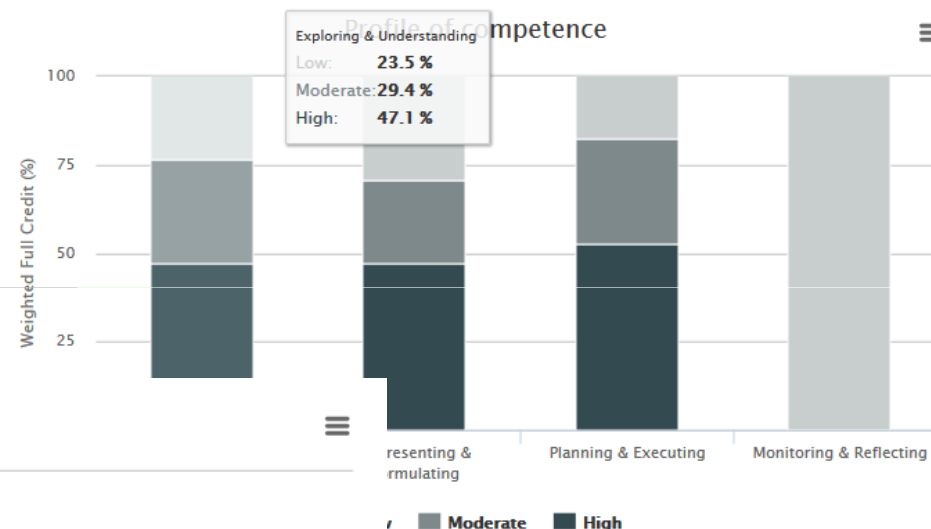
STUDENT NAME	LOW	MODERATE	HIGH	DETAILS
LEAGUE OF NATIONS	2	3	3	
EXPLORING AND UNDERSTANDING		1	1	Q1: H, Q2: H
REPRESENTING AND FORMULATING		1	0	Q1: H, Q2: L
PLANNING AND EXECUTING		0	2	Q1: H, Q2: H
MONITORING AND REFLECTING	1	1	0	Q1: H, Q2: L
ADAMS	1	2	5	
TIMMIS	2	2	4	
AMOS	1	1	6	
MINISTERS	2	1	5	
MINISTERS	2	2	4	

The ISE Delivery Tool: Implementing D-DC5.2 - Students' Monitoring – 2/4

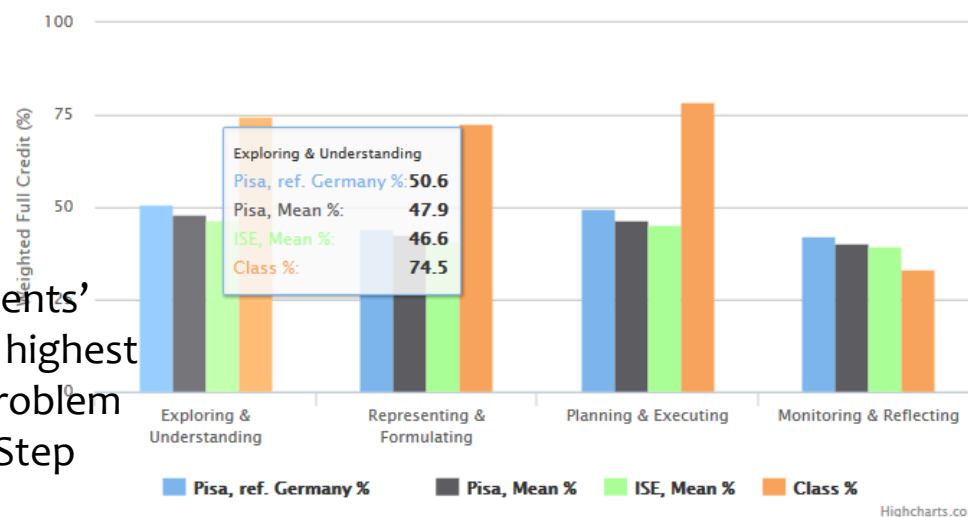
41



% of Students' Answers per proficiency levels



% of Students' achieved at highest level per Problem Solving Step

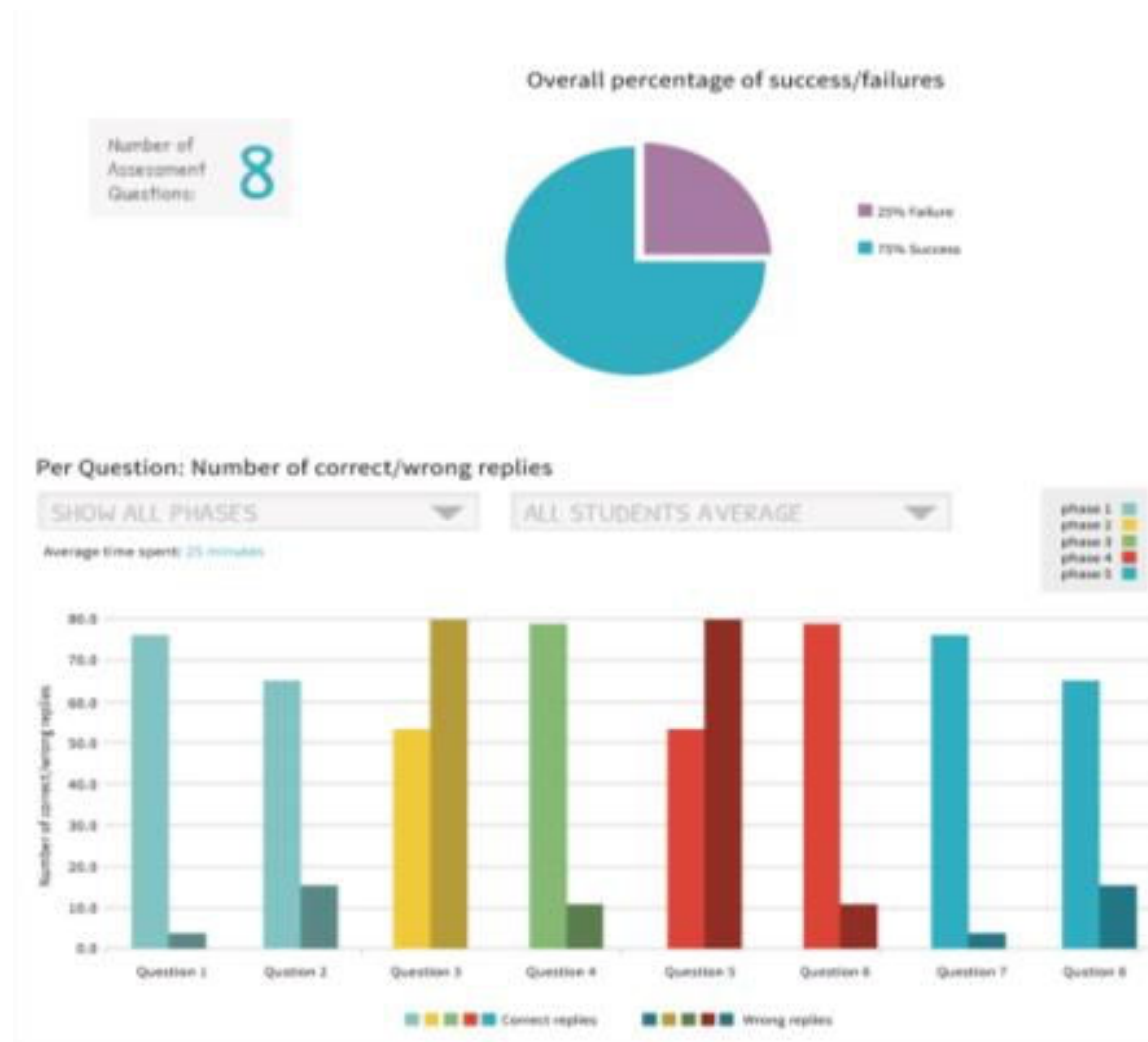


% of Students' per proficiency level and per Problem Solving Step

The ISE Delivery Tool: Implementing D-DC5.3 - Students' Monitoring – 3/4

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Visualization of students' performance at knowledge assessment questions



The ISE Delivery Tool: Implementing D-DC5.4 - Students' Monitoring – 4/4

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Students' time spent
per inquiry phase

PISA CLASS REAL TIME STATISTICS						
PISA ASSESSMENT RESULTS						
FORMATIVE ASSESSMENT RESULTS						
CLASS AVERAGE TIME PER PHASE						
NUMBER OF STUDENTS PARTICIPATED IN THE LESSON: 11						
						REFRESH
						EXPORT
STUDENT NAME	ORIENTING & ASKING QUESTIONS	HYPOTHESIS GENERATION & DESIGN	PLANNING & INVESTIGATION	ANALYSIS & INTERPRETATION	CONCLUSION & EVALUATION	OVERALL
[REDACTED]	0:28:38	0:24:3	0:13:14	0:14:5	0:0:3	1:20:3
[REDACTED]	0:26:27	0:21:41	0:25:55	0:5:31	0:0:13	1:19:47
[REDACTED]	0:26:2	0:27:11	0:25:51	0:2:26	0:0:4	1:21:34
[REDACTED]	0:26:16	0:27:30	0:25:27	0:0:34	0:0:13	1:20:0
[REDACTED]	0:28:11	0:18:40	0:26:29	0:6:45	0:0:10	1:20:15
[REDACTED]	0:26:41	0:7:24	0:45:45	0:0:42	0:0:10	1:20:42
[REDACTED]	0:9:31	0:18:33	0:26:17	0:6:27	0:0:4	1:0:52
[REDACTED]	0:31:18	0:17:11	0:30:44	0:0:52	0:0:9	1:20:14
[REDACTED]	0:31:21	0:21:35	0:25:50	0:1:12	0:0:29	1:20:27
[REDACTED]	0:26:24	0:21:40	0:31:11	0:1:46	0:0:6	1:21:7
[REDACTED]	0:26:45	0:26:49	0:26:13	0:2:10	0:0:4	1:22:1

The ISE Delivery Tool: Implementing D-DC6 - Pause and Re-Start Lesson

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The screenshot displays the ISE Delivery Tool interface for a lesson titled "FOUCAULT'S PENDULUM". The interface includes a top navigation bar with "Hi panos!", "ASSESSMENT", "SETTINGS", and "HELP". Below this, a progress bar shows five stages: "ORIENTING & ASKING QUESTIONS", "HYPOTHESIS GENERATION & DESIGN" (highlighted), "PLANNING & INVESTIGATION", "ANALYSIS & INTERPRETATION", and "CONCLUSION & EVALUATION". The main content area contains a text editor with the title "Το εκκρεμές του Φουκώ" and several paragraphs of text in Greek. Below the text editor, a message says "Finish the current section by answering some questions!". At the bottom left, an orange button labeled "▶ PAUSE LESSON HERE" is shown. At the bottom right, a blue button labeled "GO TO NEXT ACTIVITY" is shown. In the center, a grey box contains the text "LESSON PAUSED AT: ACTIVITY #2". A callout box points to the "PAUSE LESSON HERE" button, stating: "Teacher can pause a lesson at the end of each inquiry phase". Another callout box points to the "LESSON PAUSED AT: ACTIVITY #2" text, stating: "Teacher can re-start a lesson from where the lesson was paused".

Teacher can pause a lesson at the end of each inquiry phase

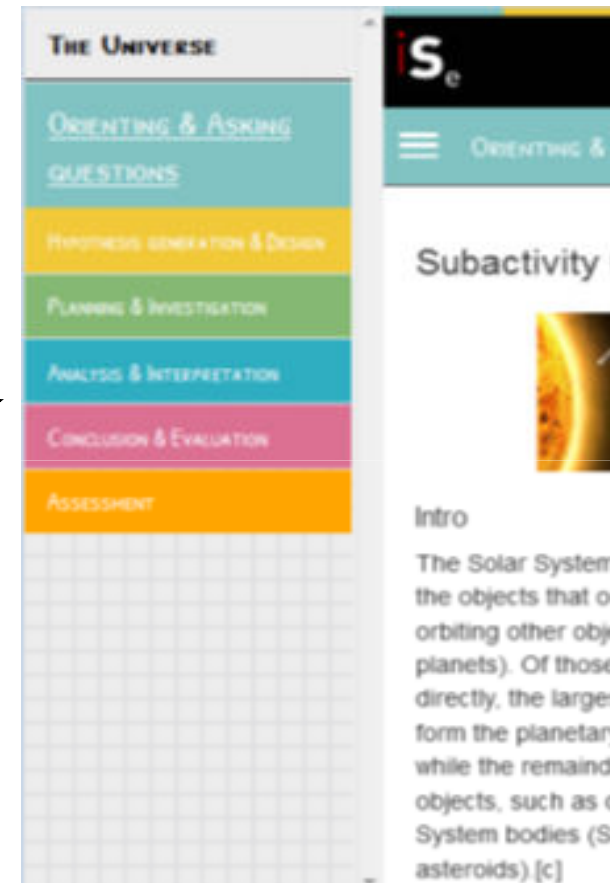
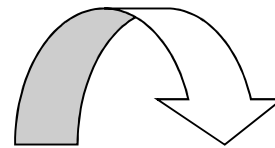
Teacher can re-start a lesson from where the lesson was paused

The ISE Delivery Tool: Implementing D-DC7.1 - Mobile Devices Compatibility

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Desktop Mode



Mobile Device Mode

(responsive behavior – the navigation bar with the inquiry phases is transferred to the left)

The ISE Delivery Tool: Implementing D-DC7.2 - Accessibility Features

46

The screenshot displays the 'Settings' menu of the ISE Delivery Tool. The top navigation bar includes the 'iS_e' logo, a greeting 'Hi panos!', and links for 'ASSESSMENT', 'SETTINGS', and 'HELP'. The 'SETTINGS' menu is open, revealing several accessibility options:

- COLOUR & CONTRAST:** A dropdown menu currently set to 'DEFAULT'.
- TEXT SIZE:** A row of five buttons labeled 'A', 'A', 'A', 'A', and 'A', with the first 'A' button highlighted in blue.
- TEXT STYLE:** A dropdown menu currently set to 'DEFAULT'.
- LINE SPACING:** A slider control with a blue circle at the left end and a '1' icon next to it.
- CHANGE LANGUAGE:** A dropdown menu currently set to 'ENGLISH'.
- MAKE BUTTONS BIGGER:** An unchecked checkbox.
- MAKE LINKS BIGGER:** An unchecked checkbox.
- CHANGE THEME:** A dropdown menu currently set to 'ELEMENTARY'.
- CHANGE PREVIEW MODE:** A dropdown menu currently set to 'TEACHER'.

The teacher/student is able to change the appearance from the top bar

Thank you for your attention!!