

“Work in Progress”

TEACHER GUIDE  
For  
STOCHASMOS

“Land in the Fog – Fly to Knowledge”

*Students think like scientists and achieve a better  
understanding of matter*

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## To the teacher

Dear teacher, you have in front of you a proposal for your teaching that follows the directions proposed by modern curriculum in natural sciences:

1. Groupwork
2. Student-centered work
3. Teaching for understanding
4. Use of ICT in Education

Through implementing this proposal you will see in a clear way how it is possible to realize in the Greek educational context the combination of: inquiry learning, increased responsibility for learning on the side of the students, use of experiments, use of drawings and constructions.

It is a challenge for success for every teacher of primary education. It was created by the collaboration of the University of Thessaly with Universities around Europe and it has been checked in pilot studies in Greek classrooms.

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<b>1. Introduction</b>	
Target Audience	5 <sup>th</sup> grade, 6 <sup>th</sup> grade students
Domain	Physics
Topic	Evaporation, Condensation of water, Structure of Matter
Driving Question	How will we make fog disappear in selected regions so that medical helicopters can land when needed?
Time	11 90-minutes weekly lessons
Class setup	Groups of three
Equipment	High-speed internet access, one computer for each group of students, LCD-projector
Learning Goals	<ul style="list-style-type: none"> <li>• deeper understanding of evaporation and condensation and of the building of mechanistic explanations</li> <li>• greater student initiative in guiding their learning</li> </ul>
Senario	Students need to help a young engineer that cannot complete his assignment. He has to propose ways to eliminate fog in selected regions so that medical helicopters can land
Assessment	Pre and post tests for summative assessment
Software	STOCHASMOS <a href="http://www.stochasmos.org/teachers">http://www.stochasmos.org/teachers</a>

### 3. Activity Sequence Overview

#### 3.1. Lesson1

<p><b>Getting to know the mission (first part)</b></p> <p>Hints for Videos:</p> <p><a href="http://www.youtube.com/watch?v=bymT5AcV-C4&amp;feature=related">http://www.youtube.com/watch?v=bymT5AcV-C4&amp;feature=related</a></p> <p><a href="http://www.youtube.com/watch?v=-3Txk_IwmSc">http://www.youtube.com/watch?v=-3Txk_IwmSc</a></p> <p><a href="http://www.youtube.com/watch?v=HWGhc5nEck0">http://www.youtube.com/watch?v=HWGhc5nEck0</a></p> <p>Hint:</p> <p><b>Question-man:</b> keeps track that he and others write down the questions that each finds important.</p> <p><b>Navigator:</b> Moves around in STOCHASMOS through the mouse</p> <p><b>Mission-man:</b> Tracks that the group work introduces new ideas and tries to use what it learns to make their idea convincing</p>	<p><b>Cognitive Objectives:</b></p> <ul style="list-style-type: none"> <li>• To get a sense of what the mission is about</li> <li>• To understand that this is a design mission (they need to control something, not just have some knowledge about it)</li> <li>• To get a sense of the available information sources</li> </ul> <p><b>Organizational Objectives:</b></p> <ul style="list-style-type: none"> <li>• To get students feel that they will have increased responsibility in organizing the inquiry</li> <li>• To assign roles and students get a first experience with them</li> </ul> <p>3.1.1 First Introduction to the Mission The mission statement is read in the classroom. Possible ways to enrich the context:</p> <ul style="list-style-type: none"> <li>• Videos</li> <li>• Previous relevant knowledge</li> <li>• Discussion about personal experiences with fog.</li> </ul> <p>Quick tour inside STOCHASMOS by the teacher using the projector. We propose that the teacher comments on things that he finds interesting but giving the sense that the whole project will be an adventure for him too. He feels confident that the class will succeed and although he has some ideas he looks forward to working with the children</p> <p>3.1.2 Classroom discussion about organizing the work The teacher helps become apparent that during the project students will constantly:</p> <ul style="list-style-type: none"> <li>• Find new questions</li> <li>• Find relevant information</li> <li>• Progress towards providing convincing solutions</li> </ul> <p>Each of these is an important goal. Based on those he could assign three roles for the members of each triad:</p> <ul style="list-style-type: none"> <li>• Question-man</li> <li>• Navigator</li> <li>• Mission-man</li> </ul> <p>The person who is responsible for a role will have to answer for the group if asked. Roles will be rotating.</p> <p>3.1.3 Teacher round up We know or can learn a lot about fog. But will we able to find a way to control it? This is where our “thinking like scientists endeavour will take us next”. In the meantime, Think of it!</p>
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### 3.2 Lesson2

#### Getting to know the mission (second part)

Hint: We propose the use of the section of the Library that refers to droplets.

Artifacts can include balls made by paper or plaster and simple observations may include spraying small water droplets, observing visible drops in various occasions etc.

#### Cognitive Objectives:

- To get students exercise in effective ways of reading the STOCHASMOS material

#### Organizational Objectives:

- To exercise their assigned roles
- To think about how they will balance work for understanding with working their solutions

#### 3.2.1 Modeling the “animation” of Physics text.

The teacher selects specific parts in the STOCHASMOS library section and models to the students how his/her reading of them is accompanied with drawings, the construction of artifacts or simple observations that help him/her get a detailed understanding of the text.

The teacher models script-like mechanistic explanations making explicit:

- The limited number of the heroes involved
- The specific and unchanging behaviour that they exhibit

Roles are reversed and now the teacher asks the students to take the initiative and try to animate a text in STOCHASMOS.

Each **Question-man** reports questions that were noted down by their group in the process.

#### 3.2.2 Classroom discussion on organizational work

Although the work done is very important for understanding Physics text does it help us to control the fog? What is the connection between constructing mechanistic explanations and controlling the fog?

The groups discuss on their own their first thoughts about coordinating “animating” text for understanding and constructing solutions.

Then the **Mission-men** report to the whole classroom the thoughts of their group.

#### 3.2.3 Teacher round up

Teacher: How should we move on? We want a rescue video. Will we be able to put all the info we need into the rescue video? This is where our “thinking like scientists endeavour will take us next”. Think of it!

<b>3.3 Lesson 3</b>	
<p><b>Making our own scenario of the mission solution</b></p> <p>Hint: Videos that could be used</p> <p><a href="http://www.youtube.com/watch?v=G00pNDd4itI">http://www.youtube.com/watch?v=G00pNDd4itI</a></p> <p><a href="http://www.youtube.com/watch?v=wxGYq1pCErc">http://www.youtube.com/watch?v=wxGYq1pCErc</a></p> <p>Hint:</p> <p>Question by the teacher: Is the fog as a whole going to be a hero, or should we see the fog as the aggregate result of other more local heroes?</p> <p>Hint: Both ways should be accepted</p>	<p><b>Cognitive Objectives:</b></p> <ul style="list-style-type: none"> <li>• To get a detailed understanding of the mission requirements (what region must be cleared from fog? How fast? How long should the clearing last?)</li> <li>• To exercise in constructing detailed scenarios of the sequence of events</li> <li>• To start thinking about who the heroes of the “dissolve the fog” story will be.</li> </ul> <p><b>Organizational Objectives:</b></p> <ul style="list-style-type: none"> <li>• To gain initiative in determining the direction of the work</li> </ul> <p>3.3.1. Scenario of the helicopter rescue Teacher: Let us try to understand very well what we need to do. Read the mission carefully. The students watch videos of helicopter rescues. The students go to the “Burnt Notebook” section of the library to get a better understanding of what they need to do. Each group under the guidance of the <b>Mission-man</b> comes to a written agreement on what the mission is. They draw snapshots of a rescue movie. Each group presents the drawings of their solution to the classroom. The class as a whole constructs the class “rescue movie” based on the good ideas of each movie. Time is mentioned in accordance to the time constraints mentioned in the Notebook.</p> <p>3.3.2. Classroom discussion on Organization work</p> <p>The part of the movie that refers to the solution needs to be fleshed up. Whatever is made needs to then fit in the broader movie. Discussion about the needed elements of a movie: Heroes, their character, the stage, the particular starting situation.</p> <p>3.3.3 Round up. Group work and classroom discussion. What options do we have now? Get as many ideas as possible or try to complete the video in detail?</p>

### 3.4 Lesson 4

<p><b>Initial ideas</b></p> <p>Teacher moves around. He does not know the solution. Emphasis on collaboration norms.</p> <ol style="list-style-type: none"> <li>1. Everybody asked to contribute</li> <li>2. Everybody may be asked to defend their opinion.</li> <li>3. Joint responsibility for the products of the group</li> </ol>	<p><b>Cognitive Objectives:</b></p> <ul style="list-style-type: none"> <li>• Students work on their ideas</li> <li>• Students think on who the main heroes will be</li> </ul> <p><b>Organizational Objectives:</b></p> <ul style="list-style-type: none"> <li>• Students decide on what they need to learn more</li> <li>• Students assign work to the teacher</li> <li>• Students decide on future work</li> </ul> <p>3.4.1 Initial ideas</p> <p>The groups work on their own</p> <p>Direction 1: Get to write as many good ideas about the possible solutions as possible. <i>Hint: Use the template “My design idea”</i></p> <p>Direction 2: Start from the missing part of the video and through careful work in STOCHASMOS try to find out who the heroes must be and what will be done with the heroes. <i>Hint: use the work in Lesson 2 about animating texts. Do the heroes of the animations give us ideas?</i></p> <p>3.4.2. Classroom discussion on organization work</p> <p>Do we need some experiments to get relevant experience? What kinds of experiments/observations do we need? Under the guidance of <b>Question-men</b> the groups decide what are the main questions of understanding the want to see answered through some experiment</p> <p>The Questions are shared and the teacher is assigned the work to find relevant experiments/observations.</p> <p>3.4.3 Round up</p> <p>Group discussion (direction 1) guided by <b>mission-people</b>: How do we work our ideas further? How do we make our ideas more convincing? Keep down the results</p> <p>Group discussion (direction 2) guided by <b>mission people</b>: What could be heroes in the movie? What options are there for them so that the fog finally disappears? Keep down the results.</p>
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### 3.5 Lesson 5

<p><b>Working the ideas</b></p>	<p><b>Cognitive Objectives:</b></p> <ul style="list-style-type: none"> <li>• Connect mechanistic explanations with intuitive ideas about dissolving the fog.</li> </ul> <p><b>Organizational Objectives:</b></p> <ul style="list-style-type: none"> <li>• To exercise their assigned roles</li> <li>• To think about how they will balance work for understanding with working their solutions</li> </ul> <p>3.5.1 Working the ideas Groups work their ideas further based on the results of the previous lesson</p> <p>3.5.2 Discussion in the classroom How is John working with his ideas? Are the questions he is asking showing us that he too is trying to make his own solution movie? (with heroes the water droplets?) Is the discussion about the heroes relevant to the discussion about creating a convincing idea?</p> <p>3.5.3 Roles Bazaar <b>Mission people</b> make a group and discuss among themselves options of future work. <b>Question-people</b> share questions of understanding and possible answers from their groups <b>Navigators</b> are coached by the teacher in a presentation of the templates</p> <p>Then the groups are formed again and think on what has been discussed.</p>
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<b>3.6 Lesson 6</b>	
<p><b>Work on the experiments</b></p> <p>Hint: keep the experiments quite simple</p> <p>Hint: Possible videos Chinese dragons <a href="http://www.youtube.com/watch?v=4WUnWpRslM">http://www.youtube.com/watch?v=4WUnWpRslM</a></p> <p>Olympic ceremony <a href="http://www.youtube.com/watch?v=4BY40QvWQKE">http://www.youtube.com/watch?v=4BY40QvWQKE</a></p>	<p><b>Cognitive Objectives:</b></p> <ul style="list-style-type: none"> <li>To get students work on mechanistic explanations</li> </ul> <p><b>Organizational Objectives:</b></p> <ul style="list-style-type: none"> <li>To appreciate the potential of the “scenario template”</li> </ul> <p>3.6.1. The teacher reports on possible experiments</p> <p>The teacher reports on the experiments he proposes and how he thinks they are related to some questions asked by the groups.</p> <p>One or two experiments are performed.</p> <p>3.6.2. Work with the experiments</p> <p>The students see video that supports multiple representations. They connect those with microscopic stories about macroscopic phenomena</p> <p>The groups work on the explanations of the selected experiments</p> <p>Classroom discussion. The teacher points the characteristics of a mechanistic explanation.</p> <p>3.6.3 The teacher introduces the students to the “scenario template”.</p> <p>Students in each group discuss (they do not write yet) how the scenario template could profitably structure their work</p>

<b>3.7 Lesson 7</b>	
<b>Students work on their ideas in detail</b>	<p><b>Cognitive Objectives:</b></p> <ul style="list-style-type: none"> <li>• To get students use simulations that help the development of mechanistic thought</li> <li>• To work on their ideas</li> </ul> <p><b>Organizational Objectives:</b></p> <ul style="list-style-type: none"> <li>• Students guide their work</li> </ul> <p>3.7.1. Virtual experiments The teacher introduces selected Molecular Bench simulations. Students can work on them in their groups</p> <p>3.7.2. Students work with the “scenario template”</p>

<b>3.8 Lesson 8</b>	
<p><b>Students work on their ideas in detail</b></p> <p>Hint: The generation of ideas should be supported. Stress however that the ideas need to be convincing. It is not enough to sound good.</p>	<p><b>Cognitive Objectives:</b></p> <ul style="list-style-type: none"> <li>• Students work on the details of their ideas</li> </ul> <p><b>Organizational Objectives:</b></p> <ul style="list-style-type: none"> <li>• Students organize their own work</li> </ul> <p>Students work on their templates.</p> <p>Between this lesson and the second the teacher puts remarks on the templates</p>

<b>3.9 Lesson 9</b>	
<b>Pairing of groups</b>	<p><b>Cognitive Objectives:</b></p> <ul style="list-style-type: none"> <li>• Work on their ideas and evaluate others' ideas</li> </ul> <p><b>Organizational Objectives:</b></p> <ul style="list-style-type: none"> <li>• Coordinate with the other group</li> </ul> <p>Students read the comments by the teacher. Groups are paired. They share their work and each group gets comments from the other.</p>
<b>3.10 Lesson 10</b>	
<b>Finalization of the ideas</b>	Students bring their templates in the final form.
<b>3.11 Lesson 11</b>	
Preparation of the final report	<p>Each group presents their ideas in the classroom.</p> <p>It is decided which ideas will be included in the final report.</p> <p>However all members of the classroom are presented as the authors of the final report (alphabetical order).</p>