KLiC (Kicking Life into Classroom)

Summary:

KLiC proposes an inquiry-based approach of science teaching pedagogy that bridges the gap between formal & informal education and brings science & scientific objects closer to the learners by engaging them in episodes of playful learning. The purpose of KLiC is to deepen the student's understanding of scientific concepts by effectively associating every day activities with scientific enquiry & experimentation, and strengthen their appreciation of scientific process & research. In order to achieve this goal a system of wearable intelligent sensors (acceleration, body temperature, heart & respiration rate sensors) embedded in everyday objects (t-shirt, ball, vest, arm/leg straps) is used and the approach is enriched with educational material (lesson plans) following the inquiry-based teaching methodology.

Aims:

KLiC aims to demonstrate an inquiry-based science education approach that uses advanced technology for teaching science through every day activities.

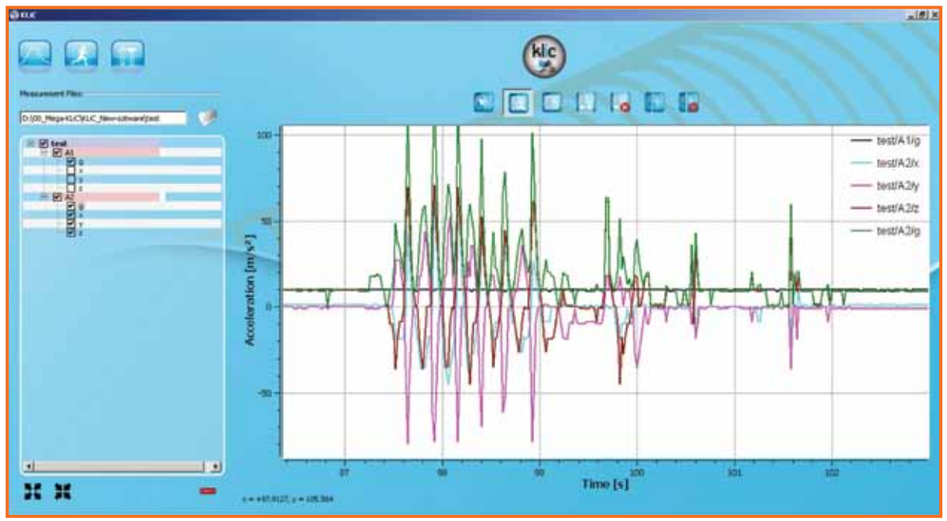
Main activities:

In terms of experimentation and collection of scientific data the main activities can be divided into two categories:

a) those where the KLiC system is used as a tool in a science laboratory demonstrating classical mechanics experiments (e.g. period of a pendulum, rigid body motion on an inclined plane, free fall)

b) those where the KLIC system is used as a tool for monitoring students' physical activities with the goal to associate various motions to scientific understanding of the world around us (e.g. physics of karate, physics of sky diving, science of sports)

In terms of data analysis and its link to the school curriculum: KLiC has developed an inquiry-based structuredset of guidelineson how students canexperience their everydayactivities in the context of science experimentation with the system enriched by a series of learning scenarios.



KLiC (Kicking Life into Classroom)

Narrative:

The incorporation of ICTs in education & training systems is becoming more & more important, allowing us to develop new approaches to learning, life and work. Furthermore, despite the increasing use of ICTs, it is strongly believed that our educational system has to shift from the traditional paradigm of teacher-directed learning to learner-centered curricula that promote the development of lifelong learners who can think critically, solve problems, be creative & collaborate at work. "Kicking Life into Classroom" (KLiC) by taking into account these aspects proposes an inquiry-based approach of science teaching pedagogy that bridges the gap between formal & informal education and brings science & scientific objects closer to the learners by engaging them in episodes of experiential learning. KLiC aspires to teach science through the use of advanced technological applications by transforming the classroom to an experimental laboratory for all. The learners perform experiments with their own data. In this way their activities are transformed to scientific experiments and their classroom or sports ground is transformed into a scientific laboratory. Such activities are viewed by the young & adult learners as a craft that rewards dedication and precision but simultaneously encourages a spirit of creativity, exuberance, humour, stylishness and personal expression.

In order to do so the KLiC uses an innovative sensor data collection tool that consists of the following modules:

- SensVest - a vest, equipped with various sensors, designed to carry components that measure and transmit physiological data to the base station.
- Leg and Arm Accelerometer - small devices attached to the leg and/or arm that enable the 3-D measurement of the acceleration for the leg and/or arm.
- Ball Accelerometer - a ball that has embedded an accelerometer measuring three dimensions and a communication unit that enables the transmission of data packets to the base.
- Base Station - responsible for the collection of all transmitted data
- User Interface Software - user friendly interface, designed with a pedagogical frame of mind, that enables the process of data and actions such as plotting data on a graph or creating a mathematical model to fit the data.

KLiC promotes the use of its application to a wide target audience, namely to science teachers, university educators & students, young & adult (amateur) athletes and implements sets of learning scenarios tailored to the needs of the diverse groups of learners.

End user:
Students grade 6-8 (ages 15-18)
Involved actors:
Science Teachers, Physical Educators, Young and Amateur Athletes, University educators and students
Location: KLiC can be used in Schools (both in science classroom and in the sports facilities), in playgrounds, in amusement parks and generally everywhere outdoors

Languages available:
www.klic-project.eu
Where to find the application or case:
The Woodlands Trust:
www.thewoodlandsfarmtrust.org/educationatrc.htm
Evaluation parameters:
KLiC has been extensively evaluated by the University of Bayreuth through online questionnaires (available in 4 languages: English, German, Greek and Romanian) specially designed for different end users of the system, mainly teachers/ educators and students. Furthermore, interviews of stakeholders (school physical educators, university staff, science teachers etc) interesting in the KLiC approach have been collected and analysed.
Connection with the curriculum:
Physics, Mechanics, Sports, Physical Education

Teachers' Competencies

1	subject matter/content knowledge	x
2	nature of science	x
3	Multidisciplinary	x
4	knowledge of contemporary science	
5	variety of (especially student-centred) instructional strategies	
6	lifelong learning	x
7	self-reflection	
8	teaching/ learning processes within the domain	x
9	using laboratories, experiments, projects	x
10	common sense knowledge and learning difficulties	x
11	use of ICTs	x
12	knowledge, planning and use of curricular materials	x
13	Information and Communication Technologies with Technological Pedagogical Content Knowledge	x

Mapping best practices with main principles

1. Building interest in natural science phenomena and explanations:

By bringing closer together the science laboratory with the pleasures and challenges students typically enjoy through play and sports, the KLiC boosts young people's interest in science. Its approach combines sports and education, a mix that brings the aspect of joy while learning.

2. Building up informed citizens: Students understanding the nature of Science & Science in society:

KLiC connects directly science to everyday life and improves the learner's understanding on how science works, contributing to the development of a new generation of citizens who are scientifically literate and thus better prepared to function in a world that is increasingly influenced by science & technology. KLiC offers the opportunity to the Life Long learners to have hands on experiences and real practices in the field.

3. Develop multiple goals:

- **understanding big ideas in science including ideas of science, and ideas about science**
- **scientific capabilities concerned with gathering and using evidence**
- **scientific attitudes**

The KLiC approach: c) Teaches science through the use of advanced technological applications. b) Transforms the classroom to an experimental laboratory for all. Students use their everyday life as the field where they conduct sophisticated experiments and thus deepen their understanding of the science concepts involved in the activities.
c) Reinforces interdisciplinary approaches in the process of learning. KLiC supports that educational experiences should be authentic and encourage students to become active learners, discover and construct knowledge.

4. Understanding students' concepts and learning style about of science phenomena:

The pedagogical approach of KLiC fosters state-of-the-art, learner-centered science teaching and learning approaches. The live capture of personal data and its analysis allows students to "visualize" their physical activity in terms of scientific parameters and fight misconceptions that they might have developed either from reading their science books or from the way they perceive things.

5. Relevance of the content to daily life of students:

The KLiC approach introduces innovative tools (systems of wireless sensors embedded in vests and balls) in science classrooms that allow for as many links of science teaching as possible with everyday life. Monitoring normal physical activity, collecting and analysing scientific data is something that is directly related to student's daily life.

6. Understanding science as a process not as stable facts. Using up-to-date information of science and education:

KLiC overcomes the barriers imposed by the traditional classroom setting by introducing to science teaching an innovative combination of a new approach to learning by applying new technologies. The learners perform experiments with their own data. In this way their activities are transformed to scientific experiments and their classroom or sports ground is transformed into a scientific laboratory.

7. Activities for gaining knowledge, not for entertainment, nor for simple imitating of results:

Utilization of KLIC system can be performed during various activities such as those in a) the school's sports ground (e.g. study of projectile motion with the KLiC ball)
b) in the science laboratory (e.g. students performing vertical jump)
In perspective, the KLiC approach is based on authentic experiences that encourage learners to become active, discover and construct knowledge.

8. Doing science: experimenting, analyzing, interpreting, redefining explanations:

A main characteristic of the KLiC approach is that it promotes an inquiry-based and problem solving learning approach. The system allows learners to freely approach the physical phenomena or parameters they want to study. By composing their own scientific inquiring strategy, students are able to engage in motivating science-inquiry activities through the use of highly interactive instruments and data manipulation tools that allow for data collection, real time data analysis and graphical representation.

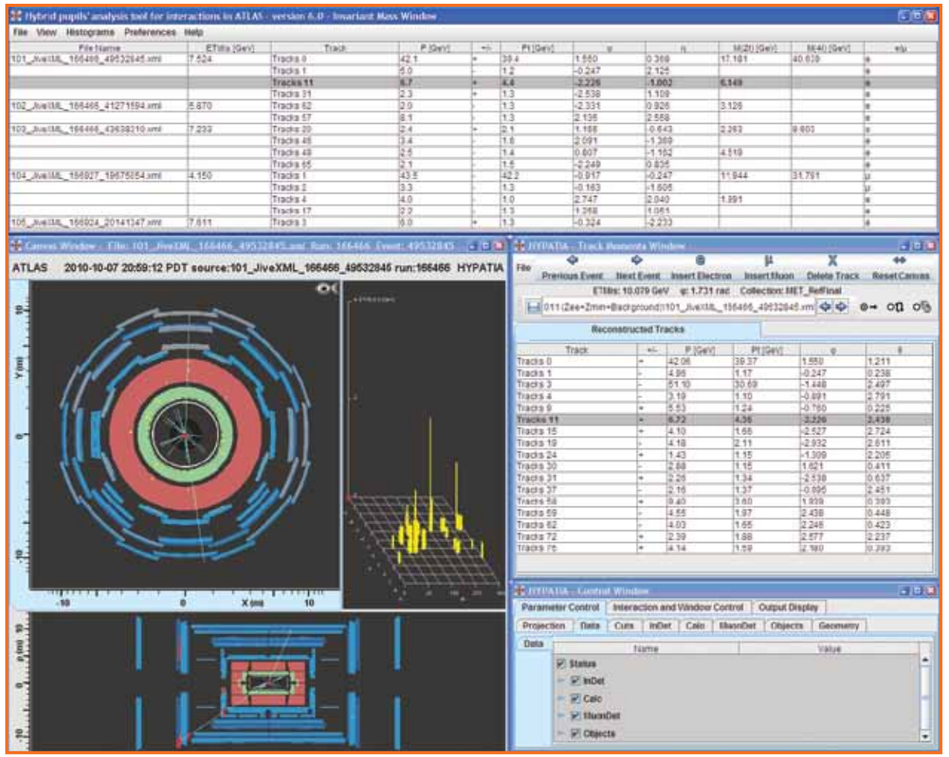
9. Assessment: formative ~ of students' learning and the summative ~ of their progress:

Since the KLiC innovative pedagogy provides to students direct interaction with scientific hands-on activities that guide them to new ways of understanding the laws of physics, it is necessary to monitor their individual skills or competencies. Given the fact that each student can perform an experiment on his own and thus can collect and analyze his/her personal data it is feasible to evaluate student's learning (through questionnaires and/or interview) and follow its progress during a series of activities that are based around the same science topic.

10. Cooperation among teachers and with experts:

KLiC brings together a real cross-disciplinary know-how, with complementary expertise among technology developers and science education experts. The implementation activities of KLiC were organized across many European countries involving large and heterogeneous groups of people. In addition, a group of science teachers has been formed, namely the KLiC User Group, that serves as a pool of ideas and exchange of practices.

HYPATIA (Hybrid Pupil's Analysis Tool for Interactions in ATLAS)



Summary:

HYPATIA is an event analysis tool for data collected by the ATLAS experiment of the LHC at CERN.

Aims:

Its goal is to allow high school students to visualize 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.

Main activities:

HYPATIA allows the use of events that have been collected by the ATLAS experiment or simulated using the Monte Carlo method. The usercan:

- Select the desired events from dedicated sets of selected events streams
- Browse the events with any order
- Study the particle tracks either through their graphical representation or through the tables
- Select from a variety of detector graphical representations
- Customize the display of information to his particular needs
- Combine multiple tracks to infer the existence of short lived particles "invisible" which decay very fast to a number of secondary particles.
- Collect interesting tracks and plot histograms of their properties
- Aggregate particles and study the distribution of their mass, momentum, angles, missing energy etc
- Use the techniques used by physicists in actual research
- Use HYPATIA to build teaching scenario (lesson plans) which fit to the IBSE