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ANNEX I "TEACHING MATERIALS"

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ADAPTATION OF INNOVATIVE PRACTICES
IN SCIENCE EDUCATION

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D.4.1. Annex I "Teaching materials"

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AIE 1: From complex to simple (RM3).

Activity 1. "Forma e funzione"

Ora guardiamo i viventi con gli occhi di….

Conosci il mito di Aracne? Rileggiamolo insieme…

"Aracne viveva a Colofone, nella Lidia. La fanciulla, figlia del tintore Idomeneo, era abilissima nel tessere, tanto girava voce che avesse imparato l'arte direttamente da Atena, mentre lei affermava che fosse la dea ad aver imparato da lei. Ne era cotanto sicura, che sfidò la dea a duello.

Di lì a poco un'anziana signora si presentò ad Aracne, consigliandole di ritirare la sfida per non causare l'ira della dea. Quando lei replicò con sgarbo, la vecchia uscì dalle proprie spoglie rivelandosi come la dea Atena, e la gara iniziò.

Aracne scelse come tema della sua tessitura gli amori degli dei; il suo lavoro era così perfetto ed ironico verso le astuzie usate dagli dei per raggiungere i propri fini che Atena si adirò, distrusse la tela e colpì Aracne con la sua spola.

Aracne, disperata, si impiccò, ma la dea la trasformò in un ragno costringendola a filare e tessere per tutta la vita dalla bocca, punita per l'arroganza dimostrata (hýbris), nell'aver osato sfidare la dea." http://it.wikipedia.org/wiki/Aracne

http://www.fflch.usp.br/dh/heros/antigosmodernos/renascimento/boccaccio/amorosa/MinervaAracneTintoretto.jpg

Secondo il mito, il ragno sa tessere una ragnatela perché è nato dal corpo di Aracne, abile filatrice. Condivido questa spiegazione?

Ma cosa è un ragno? Cosa so sui ragni?

Credo che i ragni siano nati così?

Possiamo guardare la natura sotto tantissimi punti di vista, e con diverso interesse!

Oggi al museo c'è una conferenza internazionale sulle farfalle.

Sono stati invitati tantissimi scienziati studiosi di farfalle, ma anche altri studiosi e appassionati.

Tra poco inizieranno…

Il primo che ci parlerà di farfalle sarà un entomologo, specializzato nello studio delle farfalle. Come credo ci racconterà le sue esperienze? Quali foto, filmati, disegni porterà?

Il secondo è un pittore naturalistico. Ci sta mostrando i suoi disegni. Come credo siano fatti? Sono astratti o particolareggiati?

Ora è la volta di un fotografo di riviste e libri scientifici. Come saranno le sue foto? Tra le immagini che ti abbiamo fatto vedere, quali potrebbero essere le sue foto?

L'ultimo è uno scrittore, scrive fiabe per bambini. Il suo ultimo libro parla delle avventure della farfalla Iridina. Come saranno le illustrazioni del suo libro? Tra le immagini che hai visto, pensi che qualcuna potrebbe essere inserita nel suo libro?

E ora…
Sono un entomologo, uno studioso di insetti. Alcuni aiutanti ti hanno portato degli insetti e vorresti studiarli.

Conosco questo animale?

Quando l'ho già visto?

Cosa osservo guardandoli con la lente?

Provo a disegnare quello che osservo a occhio nudo…

…e alla lente.

E allo stereoscopio?

Cosa noto osservando le forme?

Provo a disegnare quello che ho osservato allo stereoscopio. Se ho notato qualcosa di nuovo, lo scrivo

Appunti dell'entomologo

Per concludere….

Cosa abbiamo fatto oggi?

Cosa mi ha interessato di più?

Ho cambiato alcune idee su qualcosa?

Cosa penso di aver imparato?

Forse alcuni compagni oggi non sono potuti venire… come spiegherò loro quello che abbiamo fatto al museo?

Activity 2. *"*Città de Ottavia"

La vita e le regole nella fragilissima città di Ottavia (da "Le città invisibili", di Italo Calvino)

In relazione all'ambiente, gli aspetti presi in considerazione dalle due classi sono stati:

-le caratteristiche fisiche delle persone
-entità della popolazione
-le caratteristiche degli oggetti
-l'uso delle cose e delle risorse
-i comportamenti individuali
-i modi di vivere
-relazioni sociali
-i modi per addestrare le persone
-il controllo sulle regole
-l'emergenza di novità
-la lingua
-gli sport

Le strategie suggerite per adattarsi ad un ambiente precario sono state diverse nelle due classio:
-la collaborazione (associata a espressioni di ansia)
-la severità e la limitazione della libertà

Activity 3. *"*Out of windows"

Classe IV A
Presenti 18 bambini
Discussione registrata.Verbale di [Researcher name].

[Teacher] - insegnante
[Researcher] - ricercatrice

I banchi dei bambini sono disposti a ferro di cavallo. Alle pareti non ci sono poster con prodotti di quest'anno. Sulla porta è attaccata la mappa del quartiere con colori che rappresentano simbolicamente strutture diverse (case, chiesa, scuole, mercato, servizi, verde pubblico...). La mappa è stata colorata man mano che visitavano le varie strade. Non è completata.

Guardiamo i disegni dei bambini fatti guardando dalla finestra di casa il sabato mattina. Propongo un gioco: proveremo ad indovinare a che piano abita il disegnatore da come appaiono i particolari del disegno. Inizia così un esame per indizi delle rappresentazioni.

Mettiamo a terra uno e poi due grandi fogli di carta per disporci i disegni e poter avere un'immagine del quartiere. Suggerisco di mettere vicini quelli dei bambini che abitano vicino. Si apre il problema di come disporre i disegni, sul loro orientamento sul foglio, rispetto a quale punto di riferimento. Viene proposto di considerare come punto di riferimento centrale "Le Muse", il cuore del quartiere, e la casa di [Student 11] che è la più vicina a questo. Inizia una discussione accesa partita dalla volontà di [Student 9] di disporre il suo disegno al centro e gli altri secondo rapporti spaziali in scala, ma in questo modo i bambini che non abitano nel quartiere restano fuori dal cartellone, inoltre io obbietto che non basterebbe l'intera stanza se si dovesse ricostruire la mappa in scala cioè rispettando i rapporti spaziali.
Interrompo la discussione che rischia di rendere sterile il lavoro e chiedo ai bambini di ripartire dallo scopo del cartellone: perché lo facciamo? cosa dovrebbe mostrare? A cosa dovrebbe servire?
Facendo un giro di opinioni emergono sostanzialmente due posizioni: "a ricostruire le posizioni delle case sulla mappa" e "a confrontare i disegni e far vedere come è il quartiere"
Ricordo ai bambini che il lavoro era partito da una critica al lavoro precedente di costruzione della mappa, perché esso non metteva in evidenza la vita che si svolge nel quartiere. Chiedo di disporre tutti i disegni su foglio a terra e di guardarli attentamente, in silenzio, per capire quali particolari rivelano la vita del quartiere.
Dopo un poco riprendo il giro con la domanda: "Quali cose ci sono nei disegni che raccontano la vita nel quartiere?"
[Student 1]: è l'atmosfera espressa nel disegno, dal colore, che si capisce che c'è vita nel quartiere;
[Student 2]: dal movimento (le macchine, le persone);
[Student 3]: dai parchi, dai prati, perché nelle belle giornate sono visitati dalla gente, e anche se non sono frequentati, ci sono comunque gli animali;
[Student 4]: nei disegni si può capire se c'è rumore dagli oggetti; se ci sono degli attrezzi da lavoro significa che c'è qualcuno che sta lavorando, anche se nel disegno non si vede. [Researcher] commenta questa osservazione affermando che è importante anche quello che si può immaginare dal disegno, non solo quello che si vede;
[Student 5]: non è il colore la vita, ma le persone;
[Student 6]: negli elementi che una persona coglie, che decide di mettere nel disegno, sceglie le cose che rappresentano la vita (riassunto della maestra di ciò che aveva detto [Student 6]). Per [Student 6] la vita può essere rappresentata da una macchina, da una casa, che se esiste si presuppone sia anche abitata, da un garage, ecc.
[Student 7]: dall'alto sembra ci sia meno vita, non si vedono i particolari che invece potrebbero essere importanti;
[Student 8]: se ci sono tante macchine parcheggiate in un posto, significa che quel posto è "ben abitato";
[Student 9]: le macchine in movimento non rappresentano la vita del quartiere, perché potrebbero essere solo di passaggio ("come in un'autostrada, è piena di macchine ma non c'è vita"). Gli elementi che fanno capire che c'è vita possono essere le persone;
[Student 10]: la vita intesa come persone che fanno qualcosa, non che stanno a casa a vedere la televisione, che si muovono, persone che hanno voglia di fare, voglia di uscire ecc;
[Student 11]: le case fanno pensare alla vita, perché sono abitate, c'è qualcuno che ci vive dentro;
[Student 3]: le macchine danno l'idea della vita, anche se sono solo di passaggio, perchè rendono il luogo movimentato.

Prende la parola [Researcher], asserendo che nei disegni lei ha notato molte cose che fanno pensare a delle attività che si svolgono nel quartiere (negozi, signora con il carrello della spesa, furgone dei gelati, ecc). Aggiunge che anche gli alberi fanno pensare alla vita, perché sono in continuo cambiamento.

Man mano che i bambini parlano [Teacher] appunta alla lavagna le cose che vengono dette: i colori, le persone, le macchine, il movimento, la natura, le case con le persone affacciate o anche che si possono immaginare all'interno.....

[Teacher] chiede ai bambini se hanno avuto delle difficoltà tecniche nel disegnare quello che vedevano, o se intenzionalmente non hanno disegnato qualcosa.
Ilaria fa una giusta osservazione: il disegno non ti dà l'idea del quartiere in generale, ma l'idea del quartiere nel momento in cui è stato disegnato. Lo stesso posto in un altro momento della giornata può essere diverso, in orari diversi possono accadere cose diverse.
La discussione torna sui problemi tecnici.
[Student 8] nota che su due disegni che rappresentano lo stesso luogo, non sono presenti le stesse cose. La maestra dice allora che questo può essere dovuto ad una scelta dell'autore, che ha posto più attenzione ad una cosa invece che ad un'altra.
Si scopre infine che la differenza tra i due disegni (la presenza o meno di un cassonetto) dipende dalla difficoltà del bambino di disegnare. [Researcher] commenta allora che le scelte sono influenzate anche dalla casualità.
[Student 2] sostiene che le differenze nelle attività delle persone dipendono anche dalla stagione. Dice inoltre che per capire che tipo di vita c'è nel quartiere bisognerebbe fare un disegno ogni ora.

Si propone di fare altre attività:
1) fotografare ad ore diverse uno stesso punto del quartiere; 2) chiedere ad ognuno di documentare con il mezzo che preferisce un aspetto che secondo lui è emblematico della vita del quartiere.
Un quartiere, la città, afferma [Researcher], è fatta di cose che stanno ferme (le case, le strade) e tante altre cose che sono in movimento, cose visibili e cose invisibili (le persone, le automobili, gli animali, i tubi dell'acqua, l'elettricità ecc). Ci sono dei momenti in cui tutto si muove, altri in cui le cose si muovono lentamente, secondo dei ritmi. Quando si guarda la città, si vede o quello che rimane fermo, o quello che si muove, e ciò implica due modi di guardare diversi.
[Teacher] propone, per rendere meglio il movimento nel disegno, di utilizzare dei lucidi con immagini di sfondo, sovrapponendo a questi fondali "la vita" con altri lucidi che rappresentano ciò accade in quel luogo in diversi momenti. Chiede inoltre di pensare cosa c'è dietro quello che vediamo, le implicazioni invisibili delle cose visibili (il furgone dell'Algida che rifornisce il bar perché sono finiti i gelati, ecc).
[Student 12] afferma che tutte le mattine andando a scuola vede sempre le stesse cose, e questo lo annoia. [Student 9] nota invece che le cose che ritrova sempre uguali nel suo quartiere fanno ormai parte della sua vita.
[Teacher] commenta che le abitudini, che sembrano noiose, danno però un ritmo alla nostra vita.

Activity 4. "Regole"

Dalle composizioni scritte sulle regole seguite dalla discussione

Regole messe in relazione con:

-sfera di azione/ dimensione della comunità che la produce
-ordinamento gerarchico delle comunità
-relatività rispetto a chi le stabilisce
-relazione tra importanza della regola e dimensioni della comunità cui la regola riguarda (gerarchia tra regole)
-relazione tra regola e ambiente, come fattore di funzionamento ordinato
-relazione tra modi di decidere e di modificare le regole
-relazione con la libertà individuale
-relazione tra trasgressione e valutazione della trasgressione in funzione di varie caratteristiche del trasgressore
+ età
+ responsabilità
+ danno provocat
+ potere nella comunità
+ numero di trasgressori
-relazione con la trasmissione/comunicazione delle regole
-rapporto non lineare tra tipo di regola, non rispetto della regola e conseguenze

Sui cambiamenti nel tempo delle regole

I cambiamenti sono in relazione con:
-cambiamenti di mentalità che è
+ modi di pensare connessi con
· sviluppo umano
· nuove cooscenze e idee
· mode
· cambiamenti nell'ambiente

-cambiamenti delle "cose"
-cambiamenti dell'ambiente che riguardano
+ densità di costruzioni
+ densità di popolazione
+ centri e processi decisionali
+ traffico
+ nuove tecnologie
+ diverse fonti di inquinamento
+ igiene/ cura della salite

Ci sono diversità tra nazioni

Le regole "sistemano l'ambiente"

Le regole "determinano la vita"

Activity 5. *"*Sistema urbano"

In Va, dopo la visita dell'architetto del Comune, le due classi insieme ridiscutono con il ricercatore.

Ric. – L'architetto ha parlato di "sistema urbano" quando vi ha informato sul Piano Regolatore. Perché ha usato queste parole? Che significano?

Val. – perché la città è un sistema, ci sta la vita, ci stanno le regole …. Tutti i lavori che abbiamo fatto noi, praticamente ….è un intreccio di tante cose il sistema urbano, secondo me

Giu. – forse tutto quello che accade nel quartiere, nella città, cioè … in un modo o nell'altro … ogni cosa che facciamo noi nel giorno si intreccia a quello del giorno dopo, come in una grande catena

Fra: - poi secondo me è un sistema urbano in base a dove è situata, per esempio ci sta una città che è vicino alle montagne, farà freddo e quindi porterà delle conseguenze, invece se è dove fa più caldo ci saranno altre conseguenze (……)

(……..)
Leo. – secondo me (l'architetto) non si deve preoccupare solo di questo, anche delle idee dei cittadini, perché poi chi ci va ad abitare sono loro, mica lui! Quindi sono i cittadini che si devono esprimere su come vogliono le case. Certo, si devono accordare, preoccupare del clima e delle fondamenta, però sono i cittadini che ci devono vivere, quindicase che possono piacere ai cittadini o che possono attirare altre persone per favorire il turismo o altri tipi di lavoro

(……)
Ele. – secondo me la gente si trasferisce non perché ci sono cose belle ma per il lavoro e quindi gli architetti devono costruire case normali ma non troppo costose….

Support document 1: Author´s explanations for implementing the IP

Silvia Caravita´s explanations for "From complex to simple systems and backwards".

First, I wish to make a premise: the cognitive processes which is synthetically stated in the title of the project has to be assumed as a long-term process along knowledge development in school; at the same time a strategy that guides the teachers when designing their teaching intervention and during their didactical mediation.
I do not conceive the capacity to interpret complexity as the end product of a linear process, passing through stages. It is rather refined through the accumulation of many experiences, with draw-backs and new insights, when applied/transferred to different contexts which will appear simple or complex, at different grades of simplicity or

complexity, according to the perceptual, cognitive, metacognitive, emotional tools that become available.
Each new experience, may enable the students to go beyond, a bit further from their initial intuitions and makes them more ready to search for useful information and construct more adequate representations, on condition that the experience is supported by an adequate learning environment.

Question 1
The school itself and the living-area of the pupils where considered by the teachers "systems" and "complex", but this was a conceptualization that certainly children had not built of those environments, though they were implicitly aware of the presence of many components, facts, events.
Then first steps in the didactical sequence consisted in transforming the implicit into explicit knowledge and in widening and enriching this knowledge with new elements gathered by explorations and inquiries.
The assignment for the task "What do you see from your window?" was not aimed at going back to a simple system. It had the objective of narrowing the focus of attention of each student, of shifting it from the static components to events taking place in the living area, and of creating the conditions for confronting different viewpoints on the same "object" (e.g. common the living area).
It also was a temptative method for tackling the problem that had been identified or rather the dissatisfaction with the results obtained so far: the exploration of the environment had produced the construction of a map but the life going on was lacking. A very relevant acquisition of awareness revealing a deepening in the understanding of the system!
I send in attachment the reports that I wrote when I participated in the activities which followed the task (Out of windows and Forum message).

Activities such as elaborating designs for using a non-built area as park for children or re-structuring the schoolyard or using imagination for guessing the way of living in the fictitious town depicted by Calvino in the story "Ottavia" have been strategies for "going back to simple systems"

2) The software "Our World" included different spaces for supporting communication among school classes. Written reports could become web pages retrievable from a library: students sent their documents to an editorial board who sent them feed backs as referees do when authors want to publish papers in scientific journal.
Short messages could be exchanged in a space designed for discussion (Forum).
The file "Our world" in attach briefly illustrates the software.
The research carried out within the European Project CL-NET was mainly aimed at investigating collaborative learning environment and the contribution provided to cognition and metacognition by the use of tools designed for enabling communication.
The process of writing for reporting the conclusions of a work of inquiry to authentic readers was assumed to be a significant component of scientific knowledge construction, development of reflective thinking and of literacy .
The pedagogy guiding the organization of the students' work for elaborating the documents to be published in the network and the analysis of the outcomes are illustrated in the files "Library Our World" and in the article published in the French journal ASTER.

Support document 2: "Forum 'Il nostro mondo"

Classe IV A – 15/2/99

Avevo proposto ad [Teacher] di suggerire ai bambini di chiedere in rete, nel Forum de "Il Nostro Mondo", come si fa a "catturare" la vita di un quartiere. Siamo tornati in classe per preparare un messaggio di Forum. [Teacher] chiede se si ricordano cosa è un forum. [Student 9] risponde facendo riferimento all'esempio che c'era nella "demo" de Il Nostro Mondo con le domande sull'albero di cachi.

I bambini erano piuttosto stanchi.
Chiedo ai bambini di ripensare al lavoro precedente, a quello che era stato detto durante la discussione dopo il disegno dalla finestra, al problema che si sono posti; rispondono in modo un pò vago: "quando uno disegna, come rappresenta un aspetto vitale?"
Cominciano poi a formulare il messaggio che manca però di qualunque riferimento al contesto di lavoro nel quale il problema di inserisce.
[Teacher] allora scrive alla lavagna: "Nel disegnare cosa vedevamo dalla finestra della nostra casa ci siamo accorti che mancava la vita "
- non riusciva a rappresentare la vita
- non riuscivamo a capire se in quella via c'era vita
[Student 9]: ma la vita in che senso?
Vengono ricordati i commenti già fatti la volta precedente.
[Student 3] formula così una proposta di messaggio: "nell'osservare i disegni che abbiamo realizzato abbiamo avuto un problema: non riuscivamo a capire se in quella via o in quel quartiere c'era predisposta la vita"
Inizia uno scambio di interventi, principalmente tra [Student 5] e [Student 9], sull'opportunità di porre questo quesito ai bambini di Bari:
- ma loro non conoscono la città
- la nostra città, però sulla vita qualcosa sanno!
- ma la loro è diversa, non sanno come viviamo noi
- ma che c'entra! Tu pensa, se sei a Bari e ti affacci alla finestra e vedi le persone che pescano, ma sempre è vita
- come.... non la vita nostra ma la vita in generale?
[Researcher] richiama al lavoro in cui il problema è nato
- ci siamo posti il problema perché avevamo fatto la piantina (del quartiere) e lì non c'era vita
- nel confrontare i disegni è venuto il problema
[Student 10] - forse non dovremmo né disegnare, né fotografare....perché è comunque finto, la vita non c'é (ecc.....)
- per me la vita si coglie solo in certe ore
[Student 5] - non lo sapevamo rappresentare perché non lo sapevamo capire, forse non lo capisci perché non riesci a rappresentarlo
Riprendono a comporre il messaggio e [Researcher] suggerisce di formulare proprio delle domande ("cosa chiedereste ai bambini?")
- come si fa a capire se il quartiere ha vita
[Student 13] - bisogna spiegare perché guardando dalla finestra non si capisce (.....)
[Researcher] - in poche parole, nel lavoro di quest'anno che cercate di capire?
- com'è il quartiere

- da cosa è formato
[Student 9] - bisogna anche capire cos'è, qual'è la vita del quartiere
- la vita bisogna vederla con gli occhi, non filmarla o altro
- magari tu la filmi un giorno e il giorno dopo.....

Interrompiamo per andare al computer ma non riusciamo ad entrare nel programma. Riproviamo dopo mangiato e poiché non si riesce decidiamo di scrivere un messaggio di posta elettronica ad Alessandra.
"Noi stiamo studiando il nostro quartiere per sapere cos'è un quartiere. Nel disegnare cosa vedevamo dalla finestra della nostra casa ci siamo accorti che mancava la vita. Forse non si riece a capire perché non si riesce arappresentare e non si sa prappresentare perché uno non ha capito.
Come si fa a capire se un quartiere ha vita? e quale è la vita?
Come si fa a rappresentare la vota, quali strumenti si usano per catturare la vita?".

Support document 3: "Principi di programmazione"

Contenuti

*** Immagini mentali dell'ambiente in cui si vive**
- Significati personali
- Significati sociali
- Segni, documenti che appaiono rilevanti

*** Ambiente urbano letto attraverso l'analisi del quartiere**
- Lettura spaziale : Componenti, Organizzazione centro/periferia, Spazi costruiti/spazi verdi, Confini e territorio

- Lettura temporale: Processi di cambiamento e loro indizi (nei luoghi "naturali" e in quelli "costruiti")
  Dinamiche di conservazione
  Eventi di "rottura", di crisi
  Ricostruzioni storiche

- Lettura sistemica: Collegamenti tra strutture e servizi di distribuzione di beni materiali e non, tra cittadini e organi di governo,.....
  Organizzazioni funzionali
  Correlazioni tra eventi

*** Interazione Uomo-Ambiente**
- "Abitare" l'ambiente, proiettare sé sull'ambiente, modificare l'ambiente
- Inter-relazioni tra aspetti fisici, risorse e gruppi sociali, modi di vita nell'ambiente urbano
- L'estetica dell'ambiente
- Le regole e le leggi

* **Proiezione sul futuro**
- Progettualità come consapevolezza di processi di cambiamento
- Progettualità come sviluppo di possibili alternative
- Pocessi decisionali (o non-decisionali) nell'ambiente

Importanti strategie di pensiero e modellizzazioni della realtà da tenere in considerazione nella progettazione delle attività e nella mediazione didattica

* Visione dinamica di sé e dei viventi in relazione dialettica con l'ambiente
* Saper passare da modi di guardare per stati a modi di guardare per processi
* Costruire modelli sistemici di interpretazione di realtà complesse
* Ricercare relazioni tra fatti, eventi
* Accorgersi di causalità non lineari e di relazioni cause - conseguenze non sempre proporzionali (ad un fatto "piccolo" possono seguire eventi "grandi")
* Distinguere condizioni di contorno, da variabili
* Dominare scale temporali diverse da quelle di vita quotidiana
* Ragionare in modo probabilistico
* Ragionare per indizi
* Immaginare dentro vincoli dati per colmare "i vuoti" dell'esperienza (di dati percettivi, di informazione)La traccia per le attività discussa ad inizio dell'anno scolastico con gli insegnanti (classi di quarta Elementare e di prima
Media)
* Raccogliere le impressioni dei bambini rispetto al passaggio dalla scuola elementare alla media
* Come sono cambiati i percorsi casa-scuola
* Esplorare la scuola, definire le caratteristiche del nuovo ambiente, dei modi di starci, di lavorare.....(di adulti e bambini)
* Discutere sulle aspettative e proposte per starci bene (per organizzare lo spazio, i materiali, per darsi regole ...)
* Immagini dei luoghi dove era la scuola negli anni '60
* Collocare su una mappa i luoghi dove ognuno abita
* Fare l'inventario dei luoghi che sono più significativi per ognuno nel quartiere in cui vive e collocarli sulla mappa
* Discutere sulle motivazioni, sulle diversità e coincidenze
* Ricostruire se e come sono cambiati questi luoghi nell'arco di tempo della propria l'infanzia
* Registriamo una cassetta con i suoni del quartiere perché i bambini di un'altra città possano immaginare come è

Rappresentazioni simboliche coerenti con le conoscenze che si vanno costruendo

Lo sguardo sulla realtà di tipo "descrittivo" può essere tradotto in:
- appunti
- testi da comunicare ad altri
- schizzi/disegni
- mappe
- plastici
- tabelle

Lo sguardo attento alle dinamiche può tradursi in:
- diari, narrazioni
- strisce di fumetti, di foto
- collages
- disegni con ricostruzioni di ciò che non si vede
- forme grafiche che esprimono l'andamento di fenomeni
- algoritmi
- modelli plastici in serie

Lo sguardo "sistemico" può tradursi in:
- modelli tridimensionali
- drammatizzazioni
- "macchine" mobili
- schematizzazioni
- invenzione di metafore, analogie

Support document 4: "Sintesi sequenza attivitá"

SINTESI DELLA SEQUENZA DI ATTIVITA' NELLE CLASSI IVe DI SCUOLA ELEMENTARE

Unità 1 (Settembre-Ottobre) **Esplorazione dell'ambiente scuola. I cambiamenti rispetto all'anno precedente**
Classe IV A
Elenco di cambiamenti di cui i bambini si sono accorti. Raggruppamento dei cambiamenti in categorie definite dall'insegnante (scatole in cui i bambini inseriscono cartellini). Discussione in classe sulle cause e sulle conseguenze positive e negative dei cambiamenti. Proposte per l'uso di spazi.
I bambini inviano messaggi per presentarsi alle classi che compongono la piccola rete collegata da "Il Nostro Mondo".

Classe IV C
Annotati i cambiamenti. Raggruppati per tipo. I bambini, organizzati in piccoli gruppi, preparano domande su un tipo di cambiamento e fanno interviste a varie persone nella scuola: alunni, direttrice, segretaria, bidelli, insegnanti, portiere, insegnanti dei laboratori. Discussione sulle risposte (natura dei cambiamenti, chi i decide, …)

Unità 2 (Novembre-Dicembre) Esplorazione del quartiere attorno alla scuola
Classe IV A
Le classi iniziano l'esplorazione del quartiere con una passeggiata durante la quale i bambini residenti in quel quartiere illustrano agli altri le cose. Incontro con la IVC e condivisione della mappa muta. Stesura di testi individuali e loro discussione. Identificazione di categorie per raggruppare gli elementi del quartiere individuati. Stesura di testi (lavoro di gruppo) su queste categorie per gli archivi de "Il Nostro

Mondo". Discussione su metodologia e strumenti per l'esplorazione del quartiere (appunti, registratore, foto).

Classe IV C
Osservazione della carta del quartiere, individuati i suoi confini. Costruzione di una mappa (si colorano i luoghi visitati, si riportano simboli, si scrivono le leggende dei simboli). Lettura di un testo sull'organizzazione della città, le finalità e compiti delle Circoscrizioni. Discussioni di classe ("Dove porteresti un amico di un altro quartiere"? Localizzazione del quartiere e delle strade dove abitano i bambini nella pianta della città.

Unità 3 (Gennaio –Febbraio) **L'esplorazione continua guidata dall'elaborazione delle osservazioni fatte**
Classe IV A Le uscite nel quartiere proseguono in modo pianificato e con distribuzione di compiti. Registrazione di interviste a persone. Riempimento della mappa muta per visualizzare il procedere dell'esplorazione. Discussione su i luoghi che i bambini frequentano da soli.
Disegni individuali "Cosa vedo da una finestra di casa mia il sabato mattina"; confronto tra i disegni, ricerca di continuità, discussione su "Quali cose raccontano la vita nel quartiere"
Scambi di messaggi con i bambini della rete con i primi risultati delle esplorazioni e scambi di domande.
Stesura e revisione di testi individuali per gli archivi de "Il Nostro Mondo".

Classe IV C Le regole che vincolano i bambini nei loro ambienti di vita. Le regole nella vita quotidiana e le trasgressioni. Racconti dei genitori su episodi nei quali loro hanno trasgredito regole. Discussioni sulle trasgressioni.
Visita in classe di un funzionario del Comune di Roma che risponde a domande dei bambini ("Cosa fa la Circoscrizione?", "Chi e come si fanno le regole?")

Unità 4 (Marzo – Aprile - Maggio) **L'esplorazione e interpretazione del quartiere si concentra su aspetti diversi nelle due classi**
Classe IV A Capire la vita del quartiere
Sintesi delle informazioni raccolte nell'ultima uscita nel quartiere. Ricostruzione della storia che ha portato alla costruzione di un Supermercato, le domande aperte.
Lettura di un brano letterario (la scrittrice descrive ciò che si vedeva dalla finestra della sua camera) seguita da discussione e uscita alla ricerca della "vita" nel quartiere.
Visione di riproduzioni di quadri che mostrano ambienti urbani e paesaggi di altri tempi ("Cosa comunicano della vita di quei luoghi?"), stesura di testi individuali con le impressioni. Discussioni su cosa desta curiosità negli ambienti in cui viviamo e su come si fa ad accorgersi che c'è vita.
Scambi di messaggi con altre classi. Si prende dai ragazzi della scuola Media l'idea di indagare sulla mobilità delle persone nel quartiere e tra questo e il resto della città. Lavoro di preparazione di un questionario sulle ragioni di spostamento dentro e fuori del quartiere. Il questionario è distribuito alle persone durante una festa di quartiere. A questa festa le classi IVA e IVC hanno portato un poster che illustrava il loro lavoro sul quartiere.

Classe IV C Le relazioni tra regole e ambiente

Le regole nel quartiere, le regole nel Parco Regionale. Lettura critica di testi scritti da altre classi e inseriti negli archivi de "Il Nostro Mondo". Stesura di testi per "Il Nostro Mondo" seguendo un processo di "scrittura collaborativa": ogni gruppo scrive un testo, i gruppi si scambiano i testi per una lettura critica, ogni gruppo fa la revisione del suo testo. Scelta di parole chiave per l'inserimento dei testi negli archivi informatizzati.

Unità 5 (Maggio)
Classe IV A *"Il quartiere è un intreccio di ..."*
Lettura critica di documenti tratti dagli archivi de "Il Nostro Mondo".
Rilettura di tutti i messaggi scambiati con altre classi per trarre conclusioni ("cosa abbiamo capito sul quartiere dal lavoro svolto").
"Il quartiere è un intreccio di tante cose": costruzione di modellini per rappresentare questa idea (progettazione come lavoro individuale e di gruppo, presentazione dei progetti, discussione, costruzione come lavoro di gruppo).
Giochiamo a "Intreccio di parole".

Classe IV C Le regole cambiano nel tempo
Le regole in casa, a scuola: i loro cambiamenti nel tempo. Interviste a nonni e genitori. Discussione sulle interviste e sulle cause dei cambiamenti. Stesura di testi per l'archivio informatizzato di "Il Nostro Mondo"

Comunicazione del percorso e dei risultati del lavoro (Giugno)
Presentazione dei lavori nell'anfiteatro della scuola: i racconti, le mappe, i modelli, i poster.
I modelli costruiti dai gruppi di bambini della IVA sono prima interpretati dagli spettatori (bambini di altre classi) e poi spiegati.
Tra i compiti delle vacanze estive le insegnanti hanno chiesto ai bambini di raccogliere osservazioni sulla vita nei luoghi che visiteranno durante le vacanze e le regole per le persone che li abitano, (regole di cui si possono trovare tracce visibili o che si possono immaginare).

SINTESI DELLA SEQUENZA DI ATTIVITA' NELLE CLASSI Ve DI SCUOLA ELEMENTARE

Durante questo anno scolastico le due classi (IV A e IV C) hanno lavorato insieme: le classi hanno fatto insieme le uscite nel quartiere, le discussioni, gli incontri; gruppi di lavoro formati da bambini delle due classi si sono impegnati in compiti diversi.

Unità 1 (Ottobre) **Costruzione di un nuovo Centro commerciale nel quartiere: capire il processo di questo cambiamento**
Uscita nel quartiere per individuare un grande cambiamento in corso. Intervista a persone per sondare i pareri sulla costruzione del Centro commerciale. Discussione per decidere un piano di lavoro.
Classe IV C
Discussione sulle informazioni raccolte riguardo ai luoghi di vacanza. Stesura di testi per gli archivi de "Il Nostro Mondo" (processo di scrittura collaborativa).

Unità 2 (Novembre) **Intervenire con proposte riguardanti il quartiere**

Visita al cantiere del Centro commerciale. Elaborazione di una proposta riguardante gli alberi presenti sull'area dove sorgerà il Centro.
Preparazione di un cartellone (con testi e foto) e di una lettera per il Presidente della Circoscrizione per segnalare lo stato di abbandono di uno spazio verde vicino alla scuola che l'anno precedente era stato curato dal Comune con la collaborazione della scuola.
Incontro con un rappresentante del Comitato di Quartiere.
Scambio di messaggi con le scuole della rete.

Unità 3 (Dicembre) **Elaborazione di progetti**
Scelta di alcuni luoghi del quartiere sui quali ci sono cantieri aperti o che sono spazi non curati con l'obbiettivo di pensare a progetti che tengano conto di esigenze delle persone. Elaborazione di progetti e poi costruzione di plastici su: parcheggio sotterraneo, parco didattico in uno spazio adiacente alla scuola, giardino pubblico in uno spazio incolto, piazza sopra la copertura del Centro commerciale. Sono state raccolte interviste: a 50 bambini e 50 adulti. Elaborazione delle risposte.
Incontro con un architetto, funzionario dell'Ufficio del Piano regolatore della Città dei bambini e delle bambine del Comune di Roma. Visione di una videocassetta con immagini storiche del quartiere nel quale fu costruito nel 1900 il primo aeroporto della città.
Presentazione dei plastici a classi riunite e discussione.

Unità 4 (Gennaio) **Verifiche**
Le trascrizioni della discussione sui plastici sono distribuite a tutti i bambini con il seguente compito individuale: sottolineare le frasi più significative, scrivere un commento.

Lettura di un breve racconto tratto da "Le città invisibili" di Italo Calvino. A partire dall'immaginazione della città fantastica di Ottavia descritta nel racconto date le consegne per un compito individuale:
1. Disegna questa città in base alla descrizione
2. Quali regole ci sono nell'ambiente che hai disegnato?
3. Che tipo di vita c'è?

Discussione a partire dalla domanda"Perché gli architetti urbanisti parlano di *sistema* urbano? Che vogliono dire con questa parola?"

Unità 5 (Febbraio-Marzo) **Lavoro sul corpo umano**
<u>Classe VC</u>, per gli archivi de "Il Nostro Mondo"
Stesura di testi (scrittura collaborativa) sulla visita dell'architetto e sui plastici
<u>Classi Va e VC</u>
Raccolta delle conoscenze individuali sul corpo umano ("Cosa conosco del corpo umano"). Discussione sul corpo umano ("come è e come funziona"). Disegni individuali sul corpo dentro secondo l' immaginazione dei bambini.
I gruppi di lavoro approfondiscono la conoscenza delle diverse parti del corpo.
I gruppi costruiscono modelli degli organi. Ricostruzione dell'organismo.

I bambini compilano i questionari distribuiti dai ricercatori: Questionario su Ambiente, Questionario su capacità metacognitive.
Discussione sulle risposte date al questionario Ambiente.

Unità 6 (Maggio-Giugno) **Verifiche conclusive**
Su un grande poster bianco sono state scritte le parole CORPO e QUARTIERE . Si apre la discussione per trovare analogie pertinenti. Le idee, ricavate dagli interventi dei bambini, vengono scritte su foglietti post-it e questi sono collocati in posizione vicina o lontana o intermedia tra le parole-chiave scritte sul poster.
Le classi presentano il lavoro ad insegnanti di altre classi. L'insegnante della IV A introduce così la presentazione: "Dobbiamo raccontare il lavoro fatto. Partiamo dalle parole importanti che scriveremo sulla lavagna. Ognuno deve spiegare però tutto quello che sta dietro la parola, che serve a far capire il lavoro". Si costruisce così man mano alla lavagna una specie di mappa concettuale.

Alcune pubblicazioni

"Our World" nel Final Report del CL-Net European Project

Caravita, S. Le "voci" degli insegnanti. In Caravita, S., Ligorio B: (a cura di) (2003) Apprendimento collaborativo: dal gruppo alla rete. Roma: Istituto Carlo Amore.pp.187-2003.

Cesareni, D., Caravita, S. (2003) Pensiero individuale, pensiero collettivo: processi collaborativi a vari a vari livelli dal gruppo alla rete. In Caravita, S., Ligorio B: (a cura di) (2003) Apprendimento collaborativo: dal gruppo alla rete. Roma: Istituto Carlo Amore.pp. 154-172.

Caravita, S.(2004) Insegnare/Imparare a pensare per relazioni sistemiche. Atti 18° Congresso Nazionale AIP- Sezione di Psicologia dello sviluppo, 20-23 settembre 2004, Sciacca, pp.20-23.

Caravita, S. (2006) Ambiente come intreccio. Cooperazione Educativa, 55 (2), 70-78.

Documenti allegati
Schema teorico per la programmazione
Regole
Ottavia
Sistema urbano
Verifiche finali

Support document 5: "The software or "Our World"

2. The software: "OUR WORLD" (http://via.minambiente.it/)

This software has been developed with the sponsorship of the Ministry for Environment within the program A.N.D.R.E.A., which is a national database filing information about documents, initiatives and school experiences to be used by operators involved in environmental education.
"OUR WORLD" is designed as a website that affords four facilities to students: a library split into five databases where to find information ("esplorare il mondo dentro e fuori la scuola" = "exploring world in and out of school"), a forum space ("discutere con

gli altri" = "discuss with others"), a data-entry space ("produrre informazioni" = "inserting information") and an address book ("cercare indirizzi per comunicare" = "finding people to communicate with"). The software shares the educational principles of CSILE (Scardamalia & Bereiter 1989; 1993; Scardamalia, Bereiter & Lamon 1994).

The organisation of the database has taken into account categories accepted in the ecological field and also young students's knowledge. Information can be browsed, stored, produced, classified, downloaded, and linked to pre-existing files.

The forum environment can be the "place" where the students's community engages in metacognitive reasoning and shares the information at a distance. The use of Forum in OUR WORLD demands to fulfill some requirements:

- to label the opening message of a forum according to selected goals (different colours mark the differences)
- to give a title to one's own text, both when it is a message opening a new forum and when it is a reaction to an existing one
- to use no more than 1000 characters for a new opening message and 500 for a reacting one
- to select among thinking types to mark the message (agreement, disagreement, comment, new idea, question)

The full communication flow can be visualized in order to reconstruct the knowledge building process but is possible to choose the message children want to react to. In this way a non-linear sequence of messages can be created.

The use of the full website may enact a range of activities in the school classes, such as:

- retrieving documents from the data-base
- reading and commenting the retrieved documents
- writing documents to be sent to the editorial board of the data-base

- filing documents in the data-base
- participating in forum exchanges: opening a forum, reading/writing contributions to forum

The specific contribution introduced in the learning environment by these tasks and by collaboration across classes has been the main target of our investigation.
The most important leading questions of our experimental design were:
- which kind of collaboration across schools can OUR WORLD trigger and which are the demands in terms of coordination among teachers?
- does communication at distance promote or enhance specific types of collaborative learning within the class?

We envisaged the emergence of collaborative attitudes, such as expressing interest for peer's work and thinking by reading messages, asking for opinions. And of collaborative actions, such as reacting to messages, making proposals to share projects, working on other classes ideas, integrating outcomes.

Support document 5: "Verifiche finale"

Trasferimento dell'idea di sistema

"Anche il corpo è un sistema!" scopre Valerio quando in quinta si comincia a parlare del corpo umano.

CORPO **QUARTIERE**

"Hanno molte cose in comune"
"Sono entrambi sistemi"
"Sono tutti e due costruiti"

Le provocazioni dell'insegnante:

-"qual è la differenza della costruzione tra il corpo e il quartiere?" "la stessa parola *costruito* assume un significato diverso se l'attacco sotto CORPO o sotto QUARTIERE"

" il corpo si sviluppa il quartiere bisogna costruirlo"
"anche il quartiere cresce"
"in fondo fa capire che è una cosa che ha una struttura, questo vuol dire … che non è a caso, che le cose stanno insieme in un modo che non è a caso"
" costruzione va sotto SISTEMA"

-"le componenti sono tutte ugualmente importanti?!

"ci sono organi più impotanti"
"tutto è importante"
"in un quartiere se non c'è la piazza magari non succede niente"
" se il sangue non circolerebbe … è una esigenza questa qua, se no non vivrebbe e così nel quartiere se non ci fossero delle strade nessuno ci andrebbe vivere"
"necessità ed esigenze sono una cosa diversa…."
"nel quartiere, necessità … anche se non si rispettano… nel corpo invece si devono rispettare per forza tutte"

“ comunque quartiere, corpo, tutte e due però non sono autosufficienti perché tutti e due devono ...tenere un certo contatto per organizzarsi nel modo in cui si organizza l’altro, creare uno sviluppo sulla base di quell’altro (…….). Il sistema è fatto di cose che sono collegate alle altre e su questo collegamento c’è lo sviluppo intero di tutto questo sistema”

Le parole parole importanti per raccontare il lavoro che abbiamo fatto.

“Trasformazione”
“Relazioni”
“Collegamenti” *(non è la stessa cosa di relazioni?* – (le cose collegate*) hanno in comune qualcosa)*
“Regole” *(... per esempio il cuore batte sempre – se sono sistemi ci devono essere per forza delle regole)*
“Ciclo”
“Equilibrio” *(se è troppo affollato* (il quartiere) *ci sarebbe meno verde, se* (il corpo) *mangia troppo ingrassa e fa fatica a fare le cose)*

“ E struttura?”

“Struttura”

“come sistema”

“io la penserei come un sotto-insieme del sistema!

“secondo me struttura è collegato anche a regola”

“secondo me sistema e struttura stanno sempre vicine . Il corpo è un sistema perché ogni cosa ha una sua funzione e se no va a monte! Invece è una struttura …. Come lo scheletro che è formato da tante ossa”

“ secondo me il sistema è una cosa in cui circola qualcosa, ci sono degli scambi. Una struttura potrebbe essere anche un palazzo disabitato. Il corpo potrebbe essere una struttura quando è morto”

“ il sistema è una struttura funzionante”

“il corpo e il quartiere con solo strutture ma senza sistema non può vivere e viceversa!”

“Esplorare” *(abbiamo esploarto tutti e due, certo in modo diverso!)*

AIE 2: Science in family (CINVESTAV)

Support documents: Table with the summary of 36 activities

SCIENCE IN FAMILY ACTIVITIES		
No.	**Activity**	**Aim**
1	Lets do laundry	Make gel detergent using biodegradable products to prevent water pollution.
2	Water care	Discover how the impurities in water are removed-through the hydrologic cycle. Raise awareness about water care.
3	Homemade compost	To know what kind of waste is generated at home, take actions that lead us to avoid the problems with excess of waste generation.
4	Take care of the energy	Approach children to various types of energy and make them aware of the need to use energy wisely. Encourage reflection on the use of renewable natural resources nonrenewable well as the use of less polluting energy resources.
5	Vegetable paintings	Elaborate paintings with some vegetables using a simple method. Decorate various items using plant-based paints.
6	Recycle paper	Reflect the importance of rational use of environmental resources through recycling of paper. Know different ways to neutralize the waste paper, producing recycled paper and using other objects.
7	Water that you drink	Help students to discover if the water in their homes is hard or soft water.
8	Air enters air leaves	Students reflect the importance of maintaining a clean environment to maintain good air quality to allow us to have a healthy life.
9	Colors	Approach children to a better understanding of color through light and paper. Foster:Observation How many colors are there? Reflection What are the colors?
10	Win or lose	Help students to discover the importance of oxygen inside and outside of our organism.
11	Sailing with physics	Approach children to physics, especially thermodynamics.
12	Shaving cream	Help students to discover that chemistry is everywhere, some chemical changes are independent of human will as photosynthesis, decomposition of food, iron corrosion etc. Other changes are made by man as the manufacture of fertilizers, production of household products, etc.
13	DNA	Help students to discover the importance of DNA as the molecule that protects the information that defines and characterizes the different species of living organisms.
14	Rhythm	Help students to discover the importance of heart rate when doing any physical activity.
15	Ecopaint	Elaborate paintings as key elements with organic polymers, thus contributing to environmental care.
16	Swindle	Knowing the importance of starch and the presence of it in food from animals and plants.

17	Who gets up	Students know the importance of photosynthesis in the production of organic matter and the release of O2.
18	On the trail	Help students to discover the type of fingerprint they have, their family and some friends, they will identify who owns the footprints left in some objects by comparing the pattern.
19	Bacteria in my yogurt	Develop a homemade yogurt and meet the nutritional benefits of this dairy product.
20	Bubbles	Help students to discover the importance of using soap bubbles as a model to study the different branches of physics, chemistry and mathematics.
21	Like a fish in water	Develop a model to explain the mechanism that some fish use to float.
22	I eat healthy then I am healthy	Identify the importance of mechanical digestion and chemistry in the digestive system.
23	Traces from the past	Help students to discover the importance of fossils as part of cultural and scientific heritage of a country.
24	Rain gauge	Build a gauge to perform the measurement of rainfall and discover their importance in the hydrological cycle.
25	The planet is thirsty	Awareness among students in taking action for the conservation of natural areas and conserve water in the world.
26	Who is older than me?	Determine the age of a tree or its branches by counting the growth rings.
27	Reclaim the land in your hands	Determine the loss absorption capacity of soil water due to the physical degradation.
28	walking does not pollute	Make a visual quantification of particles emitted by consolidating different types of motor vehicles.
29	A look at the sky	Build a telescope that permit develop observation skills and astronomical phenomena.
30	I only count the sunny hours	Discover the importance of movements of the earth and the sun in measuring time.
31	Pest Control	Know and test the action of some plant pesticide developing a natural pesticide to work with environmental conservation.
32	Color climbing	Observe the principle of capillary action in a biological model to try to understand its importance and its applications in nature and in our everyday life.
33	Cosmetics garden	Appreciate the cosmetic value that some plants can give us then evaluate the traditional uses that give them, this improving a common cream with the addition of a preparation of aloe.
34	Calendar of ancestors	Relating the cycle of the moon with the measurement of time to assess the experience ancestors ancestral cultures of northeastern Mexico, observing, recording and analyzing the apparent motion of the moon in the sky for a month.
35	In search of light	Implement a model to observe the response on growth and development of a plant with a light conditioned stimulus.
36	Soil digger	Observe the traces of the work done by worms in the soil to understand its importance in nutrient cycling and agriculture through the establishment and maintenance of a single earthworm.

AIE 3a: "The principle of Le Chatelier" (FUB)

Outline teaching sequence: "The principle of Le Chatelier" (fisrt draft)

The principle of Le Chatelier
First Draft, November 2010
School Teacher:
[Teacher 1] (High School, Salzburg / Austria)
AIE Researchers (kidsINNscience)
[Researcher 1],[Researcher 2]

Adaptation of the Innovative Practice of FUB "Das Prinzip von Le Chatelier" of Mr. Gregor von Borstel, Germany.
It will be implemented in two classes of the same school-level in one school in spring 2011.

General Objectives:

+To develop a critical point of view: products are presented and advertised with a certain perspective by their producers. Pupils learn to highlight critically the advertised product and to compare promised effects with scientific studies.

+ "The principle of Le Chatelier" connects its taught content with a real existing product. That's the way pupils learn to apply theory in praxis. Furthermore they experience the importance of basic knowledge which is needed to understand the impact of science on our every-day life. The achieved scientific literacy promotes public understanding of science in second step.

+This innovative practice addresses national problems in science education. The results of the international survey PISA 2006 show little interest of Austrians' students in physics, especially by the girls. Furthermore shows PISA 2006 average achievements and relatively weaknesses in several parts of physical categories like 'using scientific sound'. This innovative practice should reduce these national problems.

Specific objectives:

+To foster social and scientific competencies by collaborative working: develop experiments (hands-on activities, lab-work), implement and optimize them

+To motivate and engage pupils in hands-on works through experiments and inquiry based learning activities

+To learn how to put theory into practice and how to apply learned contents in a case study

+To support pupils' learning in developing an experiment

+To support pupils' social skills by collaborative working e.g. group discussion

+To foster critical thinking by comparing promised effects of advertised products with scientific studies

+To learn how to handle special methods for physics-experiments e.g. injection-method

+To search for asked information in the web

+To transform a beverage of every-day life into a scientific object

+To learn about oxygen: does a beverage contain oxygen and how much oxygen is soluted in water under the conditions normal-temperature and normal-pressure;

+To learn about carbon-dioxide: possibilities to impact on the chemical equilibrium (in the context carbon-dioxide); solubility of carbon-dioxide under normal condition with connection to reaction equation; Factors of influence on reaction equation (temperature, pressure, pH-value); impact of soluted particles on solubility of carbon-dioxide;

Initial Activities
Teachers' input, experiments and research in the contents related to oxygen and / or carbon-dioxide as described above; this will be decided on in the next meeting with the teacher;

New Activities
In addition or as extension further inputs by the teacher, further experiments and / or other activities on the topics oxygen and / or carbon-dioxide.

AIE 3c: X-rays (UZH)

Translation of teaching sequence: How X-ray photographs are produced (by UZH).

X-rays – a combination of physics and human biology/medicine
Translation by Christine Gerloff-Gasser. This crude, summarizing translation of the teacher information sheet available on www.educ.ethz.ch has the aim to give teachers in Italy a first basis for decisions on selection and adaptation. Some text was taken from the description in the collection of the Innovative Practices in Science Education, some text was left out.

"How x-ray photographs are produced"
Teaching unit 7th or 8th grade, lower secondary level (all levels)
Authors: Toni Müller and Dr. Albert Zeyer

Content:
Students get acquainted with the spectrum of electromagnetic waves, in particular x-rays, and learn about their relatedness to light waves. Through experiments with casting shadows, the students grasp the principle of x-ray beams. After this teaching unit, students are able to come up with basic anatomical interpretations of x-ray photographs.

1. Preconditions and teaching material
1.1. Basics (in terms of the content)
- X-rays is an attractive topic of modern technology
- The underlying principle is easy, many applications
- Interdisciplinary approach: different aspects of the same topic

In this teaching unit, the emphasis is on the relatedness of x-ray beams and visible light. This way, the students can transfer their experiences with light to x-ray beams (x-ray photo as a special form of a fotographic picture).
- Finding of James Clark Maxwell (1831-1879): visible light is only a small part of the spectrum of electromagnetic waves (see figure on exercise sheet).
- X-ray beams have a short wave length, are "rich in energy". The human body, except from the skeleton, is more or less transparent for them. But x-ray beams blacken common films.
- X-ray photograph depicts the shadows the human body casts. Areas where x-ray beams are absorbed strongly are light on the x-ray picture is light. Areas where the x-ray beams pass unabsorbed are dark on the x-ray picture. Like a photo negative. This principle is familiar to students, such that this teaching unit is suitable also for low achieving classes in science and technology.

1.2. Materials for students
3 worksheets (Light and Prism, shadows and film negative, draw x-ray photographs)

1.3. Materials needed

- x-ray photographs (e.g. students bring their personal x-rays to school; see below)
- overhead projector, slide projector or beamer
- experimenting/demonstrating material for the topic 'optics', e.g. a light source producing beams of coherent light, prism
- skeleton, thorax model
- transparent plastic sheets to be cut [e.g. folders to file documents]
- optional: a camera (analog or digital) to produce film negatives

1.4. Preparation before the teaching unit

→ personal experiences of the students: Students write a brief text about their personal experiences with x-raying and collect their personal x-ray photographs if applicable (available e.g. from their family doctor or dentist – this worked very well when this teaching unit was tested).

[A group of students can share an x-ray photograph. In this case, the respective students have to take an informed decision on sharing this sensible data with their class mates. As a back-up, the teacher can provide anonymous x-ray photographs, taken e.g. from the internet. However, this lessens the direct relevance for the students of the content learned, which has been found to be a key factor to student motivation for this teaching unit.]

2. The teaching unit "X-rays"

2.1. Lesson 1: Introduction topic "x-rays"

min	activities	material
20	Put the x-ray photographs from [volunteering] students on the overhead projector. Students tell their story going with the photograph. Look at the x-ray photographs: Which bones can the students identify? Can they be located on the skeleton?	x-ray photographs overhead projector
5	Students formulate their own question about x-rays. Collect the questions on a flipchart or the blackboard. Encourage the students to also ask 'stupid' questions. - How does x-raying work? - How harmful are x-ray beams? - Why are x-ray beams called like this? - What do we need x-ray beams for? Include questions that arise later in the collection. - How where fractions diagnosed before the invention of x-ray apparatuses? - If you do not see anything on the x-ray photograph, what other possibilities are there for diagnosis? - What are laser beams? - Can light be harmful, too?	

	- How is the x-ray photograph projected on the screen?	
25	**Experiment carried out by students:** Refracted light becomes coloured [figure refraction of light by a prism]	experimental material 'optics' exercise sheet 1

Comments to the phases of the teaching:
Reports from the students
[...] The challenge is not to spend more than 15 min on this introductory part.
The spectrum of the electromagnetic waves
[...] Students have become familiar with features of x-ray beams and have been prepared that certain of these features can be observed from visible light, too.

2.2. Lesson 2: Visible and invisible light

min	**activities**	**material**
5	Take up exercise sheet 1 from the last lesson, repeat the results of the students' experiment (maybe as demonstration experiment)	exercise sheet 1
10	Visible light, infrared, UV-light, radio waves, x-rays [figure spectrum of electromagnetic waves]	exercise sheet 1 (3rd exercise)
30	Student exercise: Look for information on the internet and compile a profile of William Conrad Röntgen. The profile should include important dates, aspects of his life, his work as a researcher, and his discoveries. Footnote: This part could also be carried out in groups, presenting their results in the end. Topics could be: Curriculum Vitae of W.C. Röntgen, Discovery of x-ray beams, What are x-ray beams?	
30	Alternatively show DVD on x-rays and discuss the questions on the exercise sheet "Film".	

Internet links:
[German websites...]

2.3. Lesson 3: Building a model of an x-ray apparatus

min	**activities**	**material**
5	Repetition: visible and invisible light	
40	Group work: Build an x-ray apparatus The groups build a model of an x-ray apparatus with tables, flip chart sheets and slide projector. They receive part of the demonstration skeleton (e.g. an arm, a leg, the skull, the thorax) and draw an x-ray photograph. In addition, they draw an injury/defect in their picture	slide projector flip chart pens

Comments to the phases of the teaching:
Shadows when projecting *[no translation found for "Frontalprojektion"]*

Idea: Bones in front of a strong light source cast shadow on a screen (flip chart sheet). From behind this screen, the structure of the bones can be outlined with a pen. Students are free to create the picture as they like. Usually, students reflect spontaneously about film positives and negativef. Some students added fractures to their picture. The teacher could encourage groups to do so.
To discuss the issue about film positives and negatives, teachers can hand out film negatives from analogous cameras. Alternatively, digital photos can be transformed into a negative with help of a software [see link footnote 5].
Hint how to build the model of an x-ray apparatus: tilt a table and attach the flip chart sheet on the table's legs that are parallel to the floor. The drawing student can sit in between the paper and the table top [see picture for illustration]
Exercise sheet 2 e.g. as home work. [...]

2.4. Lesson 4: Shadow images/x-ray patterns

min	activities	material
5 (10)	Discuss or have students work on exercise sheet 2 (, shadows and film negative)	exercise sheet 2
20	exercise sheet 3: x-ray photographs from inner organs	exercise sheet 3 overhead projector
10	Look at x-ray photographs [probably on the exercise sheets] and discuss them using the newly acquired knowledge Again selected x-ray photographs from the students from the introduction	overhead projector beamer
10 (5)	Looking at the students' questions on x-rays formulated in the first lesson and later - Which questions are answered? - Which questions are to be added now?	

Comments to the phases of the teaching:
Drawing of an x-ray photograph of a thorax
Refers to exercise sheet 3. In contrast to bones, inner organs do not absorb all x-rays and therefore cast lighter of darker shadows. Some organs lay 'on top of each other' such that their absorption is cumulated. Illustration: cut out organ shapes from transparent folders of different colour and project them on the overhead projector. The students should copy the projection as black and white drawing. [...]
Looking again at x-ray photographs from the students
To close this teaching unit, it is advisable to show the students an unknown x-ray photograph from a thorax. The students can interpret it with their newly acquired knowledge. X-ray photographs from the internet can be used for a PowerPoint slide show, often the diagnosis is indicated.
When testing the teaching unit, there was no time left for this closing part because we wanted to provide enough time to discuss the students' personal x-ray photographs.

3. Supplement
3.1. Further material
[internet links from a German university and from a physics site for kids]

Teaching materials for IPs adapted by CINVESTAV

CINVESTAV 1: Minimum aquarium (RM3)

Original paper:

-Lab-work in Italian schools: an example use of a model organism in education. Webpage in Italian/English: http://www.openscience.it/opendanioeng.htm

CINVESTAV 3: Apple, apple, apple (AIE)

Original paper in German:

-Salber, A., Kröpfl, P. & Prskavec, A. (2009) Apfel, apfel, apfel. Download link: http://www.generationinnovation.at/fileadmin/document_browser/scripts/frontend/download.php?file=10

Translation of support materials:

-Partial translation to English of project description and exercise sheet by AIE.

CINVESTAV 4: Science Blogs (UFJR)

Original innovation, blog (Portuguese):

http://remexo9b7.blogspot.com

CINVESTAV 5: Kitchen Chemistry (USC)

Original documents with activities and rationale (Spanish)

–Solsona, N. (2002) La química de la cocina. Educación Secundaria. Instituto de la Mujer. Cuadernos de Educación no Sexista, 13. http://www.inmujer.migualdad.es/mujer/publicaciones/catalogo/cuadernos_educacion.htm

–Solsona, N. (2002) La actividad científica en la cocina. Educación Primaria. Instituto de la Mujer. Cuadernos de Educación no Sexista, 12. http://www.inmujer.migualdad.es/mujer/publicaciones/catalogo/cuadernos_educacion.htm

Original papers about the innovation in Spanish and Catalan

-Solsona, N. (2001c) La química de la cuina, una experiència per repensar l'ensenyament de la química. *Senderi*, 8. www.senderi.org

–Solsona, N. (2002) La química de la cuina i els sabers femenins a l'aula. *La talaia*, 4. www.bcn.es/laTalaia

-Solsona, Núria (2008) Innovación educativa centrada en los saberes de las mujeres, en Emakunde (ed) Congreso Interrnacional Sare 2008: Igualdad en la innovación, innovación para la igualdad, 83-96. http://www.sare-emakunde.com/pags2/s03_07_01.asp#subsec_6

CINVESTAV 3: Apple, apple, apple (AIE)

Translation of support documents: Apple, apple, apple (English version by AIE)

Apple, Apple, Apple
Mag. Andrea Salber
Dipl.-Päd. Petra Kröpfl & Dipl.-Päd.Andrea Prskavec

Preliminary translation: Nadia Prauhart

Translator's notes:
Project description - From apple as an object of daily life to apple as an object for scientific observation.
This information is included in the description contained in deliverable 3.1.
Please use in parallel to this paper the German version to see the photos and the format of the sheets!
The numbers of the exercises are congruent to the numbers in the German versions.

EXPERIMENTS WITH APPLES

TEAM x: (names of pupils in this group)
Is there water in the apple?

You need:
-one apple
-a small plastic bag
-something to close the plastic bag
-one plate

Cut the apple in about ten pieces and put them into the small plastic bag. Close the plastic bag very well. Now put the bag on the plate and the plate on the heating. Wait for some hours.

Lab protocol

What do you think that will happen? Fill in the following lines.

_____
_____
_____
_____

My observations:

_____
_____
_____
_____

My explanation:

_____
_____
_____
_____

Sketch of the experiment:

More research exercises to be done following the scheme of above:

1) The Egyptian Apple

You need:

-one apple
-two small plates
-one package of baking powder
-about one week of time

Cut two slices of the same size and put each of them on a different plate. Wallow one slice in the baking powder extensively. Let the other slice as it is. Put the plate away and wait for one week. Every second day, you have to renew the baking powder on the „powdered“ apple slice.

2) Apple in the Sack

You need:

-one apple
-a small plastic bag
-something to close the plastic bag
-one plate

Cut the apple into two parts of equal size. Put one half of the apple with the cut side above on the plate. Put the other half in the plastic bag and close it very well. Put both parts of the apple on a warm place.

3) Apple meets Pear

You need:

-one ripe apple
-two unripe pears

-a small plastic bag
-something to close the plastic bag
-one thick needle

Let one unripe pear lay alone in a room with normal room temperature for two days.
Put the other unripe pear together with the apple in the plastic bag. Use the needle to make some holes in the plastic bag, to let humidity escape. Close the plastic bag very well. After two days, compare both pears.

4) Sour Apple
You need:
-one apple
-one lemon
-two plates

Cut the apple into 10 pieces and distribute them on both plates. Press out the juice of the lemon and put it on the cut pieces. Take care, that each cut part is rubbed in lemon juice. Wait for one day.

5) Sweet Apple (p.6)
You need:
-one apple
-sugar
-two plates

Cut the apple into 10 pieces and distribute these pieces on both plates. Wallow the apple pieces on the one plate in sugar. Take care that each cut part of the apple is covered with sugar. Repeat this procedure each day. Wait for some days.

p. 7:
-Excursion to an apple tree with an forester
See the two pictures

-Excursion to the University of Natural Resources and Applied Life Sciences in Vienna, Department Nutrition Technology with the topic "Conservation of apples". For the experiments of the „Apple portfolio" scientific explanations have been elaborated with the team of the department nutrition technology.

-Excursion to the "Medianauten": creation of a radio play and a radio-reportage about the progress of the project.
See the two pictures

-Drawing of oils

-Design of an apple tree key pendant.

-Design of a fabric for the common tapestry

See the three pictures on p. 8

p.8:

-Bridge from the apple to the mango tree

-How can we save our forests

See the two pictures

Final phase and presentation of the project

Preparation of apple-mango-chutney and of dried apple and mango pieces which were sold by the children. The children also sold self made apple magnets for the fridge and the four self made oils. The money gathered was given to the project "Rainforest of the Austrians" in Costa Rica. www.regenwald.at
The results of the experiments and of the work were presented to all other school pupils in information tables and presentations (oral presentations)
The radio play and radio documentary was broadcasted via the school radio
As "closure" of the project and start into the new school year the class went to a "apple farmer´s house" where children helped with the apple harvest, and got further insight in the cultivation of and production with apples.

Teaching materials for IPs adapted by FUB

FUB 2: Physics and toys (USC)

Original documents with activities and instructions (Spanish)

-24 examples already available online (Spanish) with instructions about the construction of toys and the Physics involved: http://www.jpimentel.com/ciencias_experimentales/pagwebciencias/pagweb/Los_talleres_de_ciencias/Taller_de_fisica_y_juguetes.htm (High School Juana de Vega, Ávila).

-Each toy file will be available at the end of the project at CFIE León webpage: http://cfieleon.centros.educa.jcyl.es/sitio/

Original papers about the innovation (Spanish):

-López García, V. (2004). La física de los juguetes. *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias, 1*(1), pp. 17-30. Can be downloaded from: http://www.tareaescolar.net/tareaescolar/fisica/LA%20FCDSICA%20DE%20LOS%20JUGUETES.pdf

-Varela Nieto, M. P. & Martínez Montalbán, J. L. (2005). "Jugando" a divulgar la física con juguetes. *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias, 2*(2), pp. 234-240. Can be downloaded from: http://www.apac-eureka.org/revista/Volumen2/Numero_2_2/Varela_Mart%EDnez_2005.pdf

Teaching materials for IPs adapted by IJS

IJS 1: Secrets of culinary art (AIE)

Original papers (German):

-Lenz, H., Binder, R. (2006). Die geheimnisse der kochkunst im Naturwissenshaftlichen experiment. Download link: http://imst.uni-klu.ac.at/imst-wiki/images/2/2d/353_Langfassung_Lenz.pdf

Translations:

Partial translation to English by AIE.

IJS 5: Cooking with the sun (USC)

Original papers (Spanish):

-Carretero, B. (2010). El sol la cocina solar y la solidaridad: una receta muy sabrosa. *Revista Eureka de Enseñanza y Divulgación Científica*, 7(2), pp. 544-557. Download link: http://www.apac-eureka.org/revista/Volumen7/Numero_7_2/Carretero_2010.pdf

-EDUCADORES PARA LA SOSTENIBILIDAD, (2008b). Es el momento de nuevos compromisos de acción ¡podemos hacerlo y vamos a hacerlo! *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias,* 5 (3), 367-372. Weblink: http://www.apac-eureka.org/revista.

IJS 6: Science blogs (UFRJ)

-See teaching materials for CINVESTAV 4.

IJS 1: Secrets of culinary art (AIE)

Translation of original paper: Description and project phases (English, AIE)

The project was divided into 4 phases of four weeks each.

The following table is based on the table from the project description: „Die Geheimnisse der Kochkunst im naturwissenschaftlichen Experiment“, BG/BRG Gmünd, p. 7

Time frame	**Learn phases**
About four weeks	1) Basics (theoretical and practical background)
About four weeks	2) Beverages
About four weeks	3) Egg
About four weeks	4) Selected food (pizza, chocolate, pudding, jelly, paprika, frankfurter, beef

1st phase: BASICS:

Read in parallel D.3.1 p. 160, “Phases, 1)”
In the first phase of the project was exclusively tied on what pupils have already learned in regular classes. In the lab classes pupils had to realize the experiments in couples by themselves. In this phase there still was a strict division between chemistry and physics.

1.1) Basics of chemistry:
A main principle of the project was that pupils work self-directed on the experiments. This was in some cases quite challenging as there was one year of school without classes on chemistry. Some of the pupils, nevertheless, had made use of extra courses on chemistry. So it was possible to take care that the groups of pupils always had a more experienced pupil in the group – what was useful for the learning progress.

Experiments for “Basics of chemistry”

1.1.1. Distillation
Students should find out the ethanol concentration of red wine respectively beer by doing a distillation. On the basis of the standard operation procedure of the enterprise “Hedinger” the distillation equipment was built up by the students and the ethanol was totally distillated. The concentration of alcohol was reconstructed with a mandrel indicting density.

Suggestion of adaptation: I am sure that there are other enterprises providing this equipment! It must not be Hedinger…

1.1.2. Titration
Neutralisation titration: Students had to find out the concentration of hydrochloric acid by performing a titration with sodium hydroxide (NaOH) solution. Therefore hydrochloric acid was mixed with water and a universal indicator and titrated with sodium hydroxide solution of a known (given) concentration until the point of equivalence was reached. NaOH was produced by the students themselves – therefore

previous knowledge in chemical calculation and exact working was necessary. Then the concentration of HCl was found out by calculation.

1.1.3. Extraction

The method of extraction was experimented by the students by doing a classical experiment: A liquid Iodine/Potassimum Iodide (KI) solution was mixed with petroleum ether in a separation funnel. Iodine was extracted into its organic phases.

1.1.4. Chromotography

Chromotography of paper was used to demonstrate the basic principle of chromatographic methods of separation. The students had to divide colours of felt pens into their single components and then interpret the received chromatogram (qualitative and quantitative interpretation). The aim was that students learn about the method and that they are aware of the problems that may arise when interpreting chromatograms.

1.2) Basics of physics:

The pupils have had already two years of tuition in secondary school in mechanics, kinetic gas theory, thermodynamics, hydro- and aerostatics, wave theory and acoustics – these were the topics we used as basic for our work.

Also "electric circuits" had been covered in class, this topic was therefore available as common knowledge base as well. In this field the pupils used existing knowledge and trained the autonomous handling with different material.

1.2.1) Forms of heat transfer

Using the instruction sheets of company Leybold (see literature) the pupils conducted experiments on heat conduction, heat convection and heat radiation on different materials.

1.2.2) Specific heat capacity

"Why does some food keep warm longer than others?" This was the question at the beginning of this unit. At the end the specific heat capacity was calculated: The pupils heated different liquids and solids in a water bath with an immersion heater, journalized the data (mass of the object, power of the an immersion heater, duration of the heating process, rise in temperature) and used them to make the calculations.

1.2.3) Vaporization curve

The pupils worked with a Cassy-system of the company Leybolt the first time, which enables an computer-assisted recording of the vaporization curves of water, saline water and alcohol. The Cassy-system registers the data of the temperature sensor and converts it into a time-temperature diagramme and in a table. Now the results could be interpreted and be compared with manually generated diagrammes of the control group.

1.2.4) Efficiency

The efficiency of different devices which are used for heating water (cooking plate, water boiler, micro-wave) was to be determined. The assignment of tasks was kept open – this way the pupils could contribute their own ideas on how the tests should be carried out to obtain as precise results as possible. As the heating of the quite large quantities was expected to take some time the pupils also got information on the operating mode of the devices.

2nd plase: BEVERAGES

Beverages are not an immediate part of cooking but absolutely belong to a good meal. Important components of wine were analyzed, an acoustics and carbon dioxide expirement was carried out and a wine dispenser was made.

2.1) Wine

The task was to analyze different wine samples. For the analysis a test kit of the company Hedinger (including standard operation procedures) was used.

The following five parameters were assessed:

-content of sugar (quantitative assessment using the Fehling-test)
-pH-value (glass electrode)
-Content of ethanol (distillation, areometer)
-Rest extract (areometer)
-Content of acid (acidimetric titration)

After getting the standard operation procedures the pupils assembled, carried out and evaluated the experiments on their own. In order to save time, the experiments effected alone or in work-sharing, what was possible since the pupils already knew the methods. The results were summarized on posters (***see attachment***) and presented at an Open Day.

After the chemical analysis of the wine different quantities were poured in wine glasses. The glasses were hit with a spoon – the frequency of the produced tone had to be determined by using a microfon and a Cassy-system, which conducted a Fourier-analysis. Further more, various parameters were changed and the effect on the tone pitch was determined and interpreted. The pupils proposed to make the same experiment with sparkling wine, after these expirements, further experiments on the cause of the sparkling were made.

The empty wine bottles were used to produce a sound by blowing over their lip, which was also analyzed and explained physically. The fastest groups made an antique wine dispenser which used a pneumatic system to "make wine out of water" – it turned out to be a highlight at the Open Day for pupils and even more so for their parents.

2.2) Coffee

The physics of the espresso pot were the centre of the first part of this unit.

The operating mode of the pot was shown to the pupils in form of basic experiments.

The research question which had to be answered was "In order to be able to drink coffee as hot as possible after a waiting time of five minutes, should the milk be added instantly or after the waiting time has passed?"

Once again a Cassy-Measurement system was used to digitally record data and curves of the cooling process. After that different parameters (quantity of water, size and material of the cup) were changed and more cooling curves were produced. At the end the research questions was answered based on Newton's cooling law.

2rd phase: PROTEINS

3.1) Egg
In the centre of this unit were the changes of egg-white and yolk during heating as well as the chemical structure and detection of proteins.

3.1.1) Proteins
The pupils had to gather the theoretical basis for the experiment autonomously by the way of "Open Learning": They had to pass stops were they learned about chemical composition, relevance and occurrence of proteins in food. The practical part covered the structure of proteins, the analysis and denaturation of proteins.

3.1.2) The perfectly boiled egg
A perfectly boiled breakfast egg was to be produced. The first task was to determine the core temperature of the "perfect breakfast egg". The pupils had to develop the experimental set-up. For different core temperatures the texture of the egg was established – the texture of the "perfect breakfast egg" had to be defined. After that, eggs of different size were boiled until they reached the core temperature of the perfect breakfast egg – the time was measured.
The results were compared with the results of P. Barham ***(see literature)*** and explained by the terms heat conduction and coagulation. "The more eggs, the less water" is the principle of cooking with an egg boiler. In order to explain this principle, experiments on latent heat of evaporation and condensation were conducted.

The phase 4 „Selected food" will be translated if the teachers decide to implement this innovative practice.

5th phase: EVALUATION
Two evaluation instruments were used to assess the success of the project: At the end of two tuition units "One Minute Papers" were used to gather spontaneous impressions of the pupils. At the end of the project and external evaluator came to the school to carry out interviews with key questions.

Teaching materials for IPs adapted by LBSU

LSBU 1: Potatoes don't grow on trees (RM3)

Outline of teaching sequences:

-See Teaching Materials adapted by USC.

-Ideas for adapting this IP.

LSBU 2: Sunny side up (AIE)

Outline of teaching sequences:

-Ideas for adapting this IP.

Translations:

-Partial translation to English of Project folder by AIE (first two cycles).

-Sun. ("Sunny side up" attachment 1. Translated to English by AIE).

-Light and shadow. ("Sunny side up" attachment 2. Translated to English by AIE.

LSBU 4: Modelling invisible structures (RM3)

Original papers (English):

-Acher, A., Arcà, M. (2006). Children's representations in modeling scientific knowledge construction, in C. Andersen, N. Scheuer, M. P. Pérez Echeverría, E. Teubal (Eds.), Representational Systems and Practices as Learning Tools in Different Fields of Knowledge, Sense Publishers. https://www.sensepublishers.com/files/9789087905286PR.pdf

Outline of teaching sequences:

-Ideas for adapting this IP.

LSBU 5: Apple, apple, apple (AIE)

-See Teaching Material for CINVESTAV 3.

Outline of teaching sequences:

-Ideas for adapting this IP.

LSBU 1: Potatoes don't grow on trees (RM3)

Outline of teaching sequences: Ideas for adapting this IP from LBSU.

Ideas for adapting Potatoes IP

Rather than focusing on the diversity of potatoes, we would like to concentrate more on growing potatoes. We will obtain some potatoes that are beginning to sprout shoots and investigate the effects of different conditions on their early growth, eg warm or cold, dark or light, in water or in air, etc. Then we will plant the sprouting potatoes in different soil and moisture and sunlight conditions to explore these effects on growth.

We also want to look at the history of potatoes in our country and link this to global food sources in the modern day. Geography will also feature, as the countries of origins of potatoes found in British shops and supermarkets will be explored by the children.

Ways of cooking potatoes will be tried out practically, where possible, linked to scientific concepts about materials, their properties and the effects of heat on materials. Healthy eating ideas will also be part of this exploration of cooking potatoes. Cultural traditions concerning potatoes and their preparation will help to address the Cultural Diversity aspects of the KIS project.

Further science experiments on the potatoes will be carried out, to explore how much electricity can be generated from potatoes, using two metals inserted into the potato linked to wires and a voltmeter. The variables in this experiment will be the types of metal used as electrodes, the sizes of the electrodes, the types of potato, temperature, etc.

LSBU 2: Sunny side up (AIE)

Outline of teaching sequences: Ideas for adapting this from LSBU.

Ideas for adapting Sunny Side Up IP

The starting point again will be finding out what children think about the sun and helping them to raise questions about it and its relationship with the earth. Collection of all the ideas pupils have about sun with special focus on the physical-astronomical field.

Expected activities:

-Predicting, observing and measuring shadows during the day.

-Predicting and recording temperatures inside and outside buildings during the day.

-What difference does a Greenhouse make to temperatures and consequently to the growth of plants, including plants used for human food.

-Using spherical models to demonstrate day and night, seasonal changes and a solar eclipse.

-Collecting and analysing pictures of the sun from a variety of sources.

-Looking for effects of the earth's atmosphere on the appearance of the sun.
-Investigating sunspots and their effects on the Earth.
-Finding out about other radiation (besides heat and light energy) from the sun and the causes of the Aurora Borealis, when the earth's magnetic field interacts with radiation from the sun.

Translations: Partial translation to English of Project folder by AIE (first two cycles).

Cycle 1
„Sunny Side Up"

Focus: Sun and Earth
Approach: Physics and Astronomy

Subject areas:
Light and Shadow – darkness/eclipses
Times of day, seasons
Visible and non-visible light
Absorption and reflexion
Orbits of sun and planets
Drawing force and centrifugal force
Magnetism and gravitation
Air and vacuum
Energy of the sun

Action Day: "Ticket to the Sun"
(22 stations for 100 more than children)

Feasts:
Midwinter, Equinox

Meditation: Sun and Rainbow

Cycle 2
Raindrops keep falling

Focus: Sun and weather
Approach: physics

Subject areas:
Light and shadow – temperature
Measurment and comparison of temperature
Sun and weather
Air, air flows and wind
Make flows visible

The cycle of water
Aggregate states of water
Sun – planets – climate
Energy from water and wind

Action Day: „Long trip of a drop“,
(on a journey with a raindrop,
20 stations)
Feasts: children musical “plipf, plopf, plum“, in cooperation with the local music school
Meditation: „To listen to the water“

An interdisciplinary
Community Project

Pupils, teachers, parents, municipality
Each year, the parting point is questions raised by the pupils (and put up on an umbrella). These questions are answered by experiments step by step. The whole community in school contributes to the success of the project.

Division of work
Each class works on one focus.
The finalization of the project is realized in „Action days“ in which pupils show their school colleagues their knowledge and what they have found out. External experts and parents are involved.

Sustainability?
…The rhythm of four years (4 cycles) helps to make the project present for each child.
... the municipality constructed a „children´s planet path“ and involved inhabitants and visitors in the topic and activities.
…the school is member of the Austrian „Science Center Network“

Translations: Sun. (“Sunny side up” attachment 1. Translated to English by AIE).

SUN
The start was that children should think about what they wanted to know about “sun”. Collection of all the ideas pupils had about sun with special focus on the physical-astronomical field.

The very first questions:
1) Why the sun is called “sun”?
2) How old is the sun?
3) How was the sun “born”?
4) Why has the sun a round shape?
5) Does the sun turn, if yes, how fast?

6) What happens if the sun explodes?
7) Can the sun die?
8) Why doesn't get the sun swallowed by a big black hole?
9) How big is the sun?
10) When has the sun the tallest size?
11) How heavy is the sun?
12) How far is the distance between sun and earth?
13) Why is the distance that long?
14) How hot is the sun?
15) What does the sun exist out of?
16) Why does the sun burn but not burn up?
17) Why doesn't the sun flow away as it's so hot that everything starts melting around?
18) How long does it take to go to the sun?
19) Does the sun make noises?
20) Why doe we see the sun yellow – is this its real colour?
21) What about the genesis of shafts of sunlight?
22) What about the formation of shadow?
23) When arises the sun – how does she know the time?
24) How does the sun spread all its light on all countries?
25) Why is it in Egypt hotter than in our country?
26) Why do we get brown by the sun?
27) Why doesn't the sun crash down?
28) Why does earth turn?
29) How many planets do we have, which one is the biggest and why isn't the sun a planet?
30) Why is the sunlight hotter in summer than in winter?

…

Categorization of topics after collecting the questions:

e.g. formation of the sun and the planets; construction of the sun – sight into the sun size, distance; magnetism and gravitation; sun-system, stars and planets; light/shadow, day/night, seasons, darkness; air and vacuum; energy from the sun, deflexion and absorption, light spectre;

Chapter THE SUN, p.4-6:

…sea pictures

…the table contains information about size, Masse, weight, rotation, Kern, heat, energy, temperature, surface, corona, kern, colour, distance, age, length of life, etc.

Useful links follow

"It was not possible to get all the copyrights. Therefore I ask you to download the pictures that are of interest for you. … Most of the links are originally in English…."

Experiment about surface and gas: "Is it possible to walk on the surface of the sun?"

(see picture) mixture of oil and aluminium-powder

The aim of this exercise is that pupils are able to imagine the surface of the sun.

Translations: Light and shadow. ("Sunny side up" attachment 2. Translated to English by AIE).

LIGHT/SHADOW, DAY/NIGHT, SEASONS, DARKNESS

Light and shadow are completely normal in every-day-life and pupils do not really perceive it any more. In the project, they started to observe again and found out a lot.

Pictures on first page:
If sun shines, everything makes/has a shadow, shaft of light are straight-lined.
Long and short shadow (pupils observed and compared their shadow every hour)

Pictures on second page:
Picture 1) snow-man changes its colour every hour, change of the shadow of the broom
P. 2) everything has two sides: a light- and a shadow-sight
P. 3) everything also makes a cast shadow

Pictures on third page:
P. 1) Visibility of light: usually, beams of light are not visible but they can be made visible with humidity or powder
P. 2) Hard and soft contour: depends on the distance from the light-source
P. 3) Different impact of light on human beings, animals and plants (cold, warm, spooky, funny light etc. – has an impact on climate as well)

Pictures on fourth page:
Colours change: light and shadow change the colours
Serie of four pictures: Every 10 minutes a photo was taken. It was the idea of the children to take the photos. Children found out that the shadow is moving.

Pictures on fifth page:
Light and shadow moves: picture taken every 10 minutes; at same time, sun moves as well;
Sun clock: who moves? Sun or earth?

Pictures on sixth page:
Day length and sunset: difference between south, north and equator
Run away from the light: shadow always follows you; can you jump over your shadow?

Pictures on seventh page:
P. 1) Surface of moon – how saw and painted Galileo the moon?
Experiment: A pupil stands with a basketball infront of the blackboard. Strong light (overhead) is illuminating the child with the ball, the pupil moves and the classmates talk about the phases of the moon. In each phase the child stops for a moment.
P. 2) Day and night, seasons: experiments about it with "self-made earth"

Pictures on eighth page:
Solar eclipse: experiments about it: light is the sun, ball the moon and paper the earth; the wholes on the earth are different places on earth

Pictures on ninth page:
P.1) Total lunar eclipse
P 2) Light and shadow in space: light can't be seen because there is nothing to reflect the light, except space-shuttles, planets or an astronaut

Page 10:
Useful links

LSBU 4: Modelling invisible structures (RM3)

Outline of teaching sequences: Ideas for adapting this IP from LBSU.

Ideas for adapting Modelling invisible structures IP

The trials of this IP will probably begin later in 2011, in a school or schools still to be identified. Early ideas about adaptation include: -

Looking at a birthday cake candle as it burns and helping children to mime the changes in the materials which take place.

Exploring a selection of seeds from plants and asking children to draw their own ides of what is inside the seed case.

Thinking about and acting out the changes that take place inside the chrysalis of a moth or butterfly, as the cells are rearranged from a work like creature into a winged adult.

LSBU 5: Apple, apple, apple (AIE)

Outline of teaching sequences: Ideas for adapting this IP from LBSU.

Ideas for adapting Apple IP

Bring in some more science suitable for older children – ages 9 to 10 years. Open up some questions of a more advanced nature and ask for children's own ideas about investigating apples, e.g.

Do cooking apples go brown faster than eating apples when they are cut?

What factors influence the rate of ripening of apples? Eg cold or warm conditions – inside plastic airtight bags? Wrapped in newspapers and kept in a cool place? Other ripe or ripening fruit nearby?

Can you use an apple to generate electricity?

What apples are best for making into juice?

We thought that the project could work well also in nursery/kindergarten, where we would encourage the children and their teachers to use digital cameras to record the changes occurring. The Sour Apple and Sweet Apple activities would be especially suitable, since the changes take place in a shorter time than some of the others, which may take a week or more. We would want to children to use their senses more too, e.g. sense of smell, with the cut apples and with the lemon. The resources are easy to get.

Another area we might want to work on is making Apple-based recipes, like Apple Pie – with the very young children, since it would help them develop so many important practical as well as social skills. We would emphasise the equality of gender in the context of cooking, to overcome the misconceptions that it is always the "mother" who does the family cooking.

Teaching materials for IPs adapted by RM3

RM3 1: Science across the world (LSBU)

-See Teaching Material adapted by UFRJ.

RM3 2: Posing the question why (AIE)

Original paper in German:

-Kernbichler, M., Kerschbaumer, H. (2008) Zum verstehen kommen. Naturwissenshaftliches lernen und sprache. Download link: http://imst.uni-klu.ac.at/imst-wiki/images/0/00/1442_Kurzfassung_Kerschbaumer.pdf

Translation:

Partial translation to English by AIE of "Posing the question „WHY" "and most of the list of experiments: The flame Water – Ice, Waster – Colour – pap of disgust (pappa nauseabonda).

RM3 3: Cooking with the sun (USC)

-See teaching material for IJS 5.

RM3 4: Secrets of culinary art (AIE)

-See teaching material for IJS 1.

RM3 6: Sunny side up (AIE)

-See teaching material for LSBU 2.

RM3 10: X-rays (UZH)

-See AIE 3c and teaching material adapted by UFRJ and USC.

RM3 12: Renewable energy (AIE)

Translation:

Partial translation to English of the main sections of the project by AIE.

RM3 14: Physics and sports (AIE)

Original papers (German):

-Duenbostl, Th. (2005). Physik und Sport. MNI -Fonds für Unterrichts- und Schulentwicklung. S 6 „Anwendungsorientierung und Berufsbildung". http://imst.uni-klu.ac.at/materialien/2004/279_endbericht_duenbostl.pdf pp. 1-49

-Oudin, T. (2010). Physik im Sport. Umsetzung eines bereits durchgeführten Physikprojektes in 14 Klassen an 9 Schulen. Fonds fürUnterrichts- und Schulentwicklung (IMST-Fonds). S 6 „Anwendungsorientierung und Berufsbildung". http://imst.uni-klu.ac.at/imst-wiki/images/4/4c/334_Langfassung_Winkler.pdf pp. 1-34.

Translation:

-Partial translation to English of Physik und Sport (Duenbostl, Th.) by AIE Physik und Sport (Duenbostl, Th.): Item "Speed" translated; headers of parts "Jump" translated, to be read together with the original material because of the photos, graphics and diagrams.

RM3 17: Food digestion (IJS)

Translations of original activities:

-Food as fuel. What types of substances is food composed of? How can we determine those types of substances? Exercise groups 1&2.

Support documents:

-Fat synthesis (English)

RM3 2: Posing the question why (AIE)

Translation: Partial translation to English and selection of topics by AIE

3. Course of the project

3.1.1 Experiments – Inducement to start thinking processes and to finding solutions on their own
See the project description in D.3.1, p. 17

3.1.3 Posing the question „WHY“
The aim of the scientific work in the field of natural sciences is to give explanations and to quote arguments that support a thesis.
Therefore the project offered time to reflect on experiments and to pose the question “why?” and to find explanations. In this way, students can get a basic understanding of scientific work.

3.1.4 Posing the question „WHY“ – examples of various topics:

Topic		The flame – hints of a transformation
Investigation on the previous knowledge and ideas of the pupils		The question “What is it that burns?” the pupils of the first and second class agree on: it is the candle. They are quite sure that a flame could not burn without air, but the processes (fuel and burning temperature) are very abstract to them, they are unconscious to them.
Argumentation		Why does the flame burn…?
Experiment	**What is observed / Why?**	**Introduction of technical terms (not technical terms in the sense of scientific terms)** Please see the comment[1]
Even the candle is breathing	The flame extinguishes / Why does the flame extinguish?	oxygen
Jumping flame	Steam inflames / Why does the spark jump over?	Wax, steam, liquid
The wick burns	Without wax the wick	wick

	would burn very quickly	
The wick absorbs liquid	Liquid „ascends“	liquid
Hold metallic things into the flame?	Grime (carbon black) is formed / when millions of small pieces of grime glow, they gleam brightly – now we see black carbon / Where does the carbon come from?	Grime (carbon black), carbon Glowing pieces of grime cool down
Flames produce sound	Observe the flickering of the flame in air current / Why does the flame flicker?	Air current
To kindle a candle	Observe the “lake of wax” which is formed	solid – liquid
Blow out the flame of the candle	Observe the grey white steam	gaseous steam of wax

[1] In the Roman languages, it is more difficult to distinguish between colloquial, “appropriate terms” and technical terms. To give an example of German: little children say “Luft” and mean “oxygen”. “Oxygen” would be the technical term in German. What we mean here by “technical term” (= “appropriate term”) in the column is the appropriate – technically correct - but common word: “Sauerstoff” - this is not “children language” anymore, but it is not really technical (comment by Prauhart, AIE)

Observations and experiences (from the teacher)[2]: This topic was quite abstract for the pupils at the beginning. Nearly no child knew that wax gets liquid when it is burned. The argumentation “What burns?“ was developed out of the observations. Additional experiments like absorption of liquids were realized to see that the wick observes the liquid wax. The experiment to burn the wick without wax helped the pupils to find out that it is not only the wick what burns, but that it absorbs the wax. After these experiments the pupils were able to explain the other phenomena and liked to use the recently acquired vocabulary of „technical terms“.

Topic	Water - Ice	
Investigation on the previous knowledge and ideas of the pupils	Ice is connected with cold. The children have experience with snow and ice in their direct surrounding (in Winter). The aim here is to observe knowingly and willful, formulate and explain and interpret the experiments.	
Experiments	**What is observed?**	**Introduction of technical terms (not technical terms in the sense of scientific terms)**
What will be melted down first?	Observation of ice cubes in a glove / in aluminium foil. Why does the ice cue in the aluminium foil melt down first?	warmth - cold
Bottle with water in sub-	The bottle bursts.	expansion

zero temperature		
Snowball in water	Estimate, observation of the water level / Why does the water level barely change?	water level
To broil ice	Melt and vaporize / Where does the water disappear?	Solid – liquid – gaseous
To colour snow	Make the surface visible	surface

[2] Here the teacher describes her experiences and observations of the reactions, understanding and ability of argumentation of the students. (comment N.Prauhart, AIE)

Observations and experiences (from the teacher):
Within this area children had more daily experience – the argumentation and talking about what they observe was easier. (…)

Topic	Waster – Colour – pap of disgust (pappa nauseabonda)	
Investigation on the previous knowledge and ideas of the pupils	Nearly no child had previous knowledge of this topic and experiments. Therefore the argumentation of the children was very exciting and fascinating.	
Argumentation		How do the smallest particles "act"?
Experiments	**What is observed?**	**Introduction of technical terms (not technical terms in the sense of scientific terms)**
Paper clip swims	Water particles "stick together very strictly" / Why does water form a convex surface?	Surface tension
Paper clip swims – toothpick with washing up liquid	Washing up liquid contacts the water / what does happen because of the contact with the washing up liquid?	Destroying of the surface tension
"Confused" colours	Drops of food colouring into milk / What happens because of washing up liquid?	Surface tension
Pap of disgust	Observe the reaction of the pap of disgust (made of starch flour and water. Scientists call this type of liquid "colloid". The more firmly it is hold, the harder it feels, when you release it, it is liquid.) Why does it feel as if the pap is firm and then liquid?	Solid – liquid colloids

There are also experiments on photosynthes

RM3 12: Renewable energy (AIE)

Translation: Partial translation to English by AIE.

Title: ENERGY 21
Renewable Energy

Summary of the project planning – project objectives

Preparation of the project

At the beginning of the project the state of knowledge of the students regarding conventional and renewable energy, consumption of electricity, climate change and greenhouse gas emissions was found out via questionnaire.
In a second phase, the "input phase", the aim was that students acquire knowledge about the topic by applying various methods.

The project was accompanied by the Research Institute of the PH Diözese Linz within a cooperation project of didactic research.

Project planning

-Analysis of the problem
Students´ opinions regarding climate protection is often diffuse and striking because of:
+Lack of awareness of the problem
+Insufficient knowledge of the problem
+Insufficient interest in the problem

-Analysis of the potential of students:
At this age students are very sensible regarding problems that influence their future, but not experienced enough to realize the actuality and importance of these problems:
+Openness to experience,
+honesty,
-curisousity and interest
are the ideal preconditions to support them in becoming responsible adults who are aware of problems

-Definition of objectives of the project: see below
-Some thoughts regarding methods
+Finding out the previous knowledge: by brainstorming – Clustering
+Mind-Map
+Creative techniques
+Photodocumentaion of the overall project
+Partner and group work
+Creation of information posters for the whole school
An information wall in the foyer of the school informs about the actual status of the project
+Technical terms in English on flash-cards

+Excursions to research institutes, innovative enterprises and appliers of alternative energy systems. In Austria, they visited e.g. producers of solar power systems and a low or passive house, a windpark and a biomass power plant.

+Repertory Grid – method, a well known knowledge acquisition and representation technique, method to acquire individual specific information. Applying this method, students interview their parents and learn to collect, interprete and represent information. The method refers to George Kelly („personal constructs“).

+Knowledge presentation by using a “Topic Map”. A method of knowledge organisation/management, an abstract document to formulate structures of knowledge:
Elements of a topic map are:
Topic – variable to describe a person or an issue/thing
Topic Types – specify structures
Associations – describe the relations between topics
Occurrence – an information or resource which is relevant for the theme

+Mid-term and final presentation

Projects objectives

-Find out students´ previous knowledge

Student´s should achieve (to)

-Differentiate between renewable (wind, biomass, water, sun) and fossil energy resources (carbon, mineral oil, uranium and petroleum gas)

-Get basic knowledge

-Create and develop a mind map or topic map about the topic

-Awareness raising

-Realize research on the topic

+What are the activities of politics?

+What are the objectives of the European Union?

+What does the energy supply look like (Austria, world wide)?

+What are the ambitious aims of some countries?

-know technical terms

-holistic searching for solution

-deal with the topic with creativity techniques (photos, posters, flashcards,...)

-analyse of advantages and disadvantages

-„mathematical“ challenges:

+Creation of tables of consumption

+Interpretation of tables

+Calculations

-Repertory Grid – realize interviews

-Creation of a questionnaire – realization – interpretation

-Amplification of the English treasury of words (technical terms)

-Compare prices

-Analysis of problem and potential in the own family

+What are we doing?

+What can we do?

-Get to know innovative enterprises

-Test overhasty conclusions for suitability

-Be aware that complex issues need an objective overall look

-Think about and discuss futures scenarios

Project group:

8 – 10 interested students of the lower secondary school „Praxishauptschule“ of the University of Education of the Diocese of Linz joined the non-binding class „Science group“.

RM3 14: Physics and sports (AIE)

Translation: Partial translation to English by AIE

Notes from AIE:

To the teacher and our colleagues from RM3:
For the general overview of the project see also the project description in Deliverable D.3.1, p. 156
For getting a better idea of the project, use the German project description in parallel when reading this. There are a lot of photos and graphics!
We concentrate here on selected parts of the project: on the parts "Speed".
We kept strictly to the numbering in the German project description. At the end of the document, you find the headers of the chapter "Jump"

2 Subject and method
2.1 Speed measurements
2.1.1 Average speed and instantaneous speed

Velocity (symbol: v) is a vector measurement of the rate and direction of motion or, in other terms, the rate and direction of the change in the position of an object. The scalar (absolute value) magnitude of the velocity vector is the speed of the motion. In calculus terms, velocity is the first derivative of position with respect to time.
The unit of speed and velocity is the meter per second. This unit is only rarely used outside scientific and academic circles. Most people on this planet measure speeds in kilometer per hour (km/h or sometimes kph).
When an object moves at a constant speed (or rate) it is said to be in uniform motion. In practice the velocity changes continuously, so always the average velocity is measured.
Instantaneous velocity, in one dimension, is defined as the velocity at a particular instant of time. In Sport often the velocity at certain place and certain time are of interest. Instantaneous velocity exists only from a theoretical point of view. It is necessary to measure the velocity over a specific distance.

Exercise: The speed, which the pupils need running one meter should be measured by using two light barriers at a distance of one meter and a time measuring device. During a second take the distance between the light barriers is reduced to 20 cm, so that it is rather instantaneous speed we are talking about. Subsequently a 60 m running track should be divided into 10 equal sections by light barriers and the velocity course should be measured in the ten individual stages.

2.1.1.1 Measurement of speed and distance while running

While running a short distance of 10 m light barriers are set at a distance of every meter. The light barriers are connected with a time measuring device, which stops time when crossing the light barriers. The measurement results are used to calculate speed.

2.1.1.2 Starting time and starting acceleration
In addition to the time measurement the start time is recorded and used for the calculation of the start acceleration (start time up to the light barrier at a distance of 5 m).

2.1.1.3 Velocity, acceleration and stopping distance while running
Subsequent to the speed measurements the stopping distance and deceleration should be determined. The pupils should stop quickly after passing the second light barrier. The stopping distance is measured accurately with a measure tape and from the measurement data (stopping distance, speed) the deceleration can be calculated.

2.1.2 Evaluation of speed and acceleration while running by video analysis
From a video sequence showing a starting runner the starting acceleration, the average speed should be determined with the help of a video analysis program.

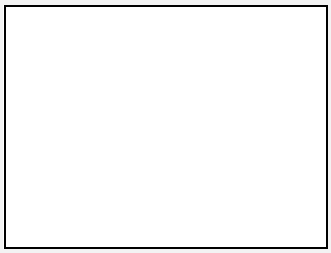
2.1.3 Average velocity during a 60 m run divided into equal sections
The velocity course during a 60 m run should be determined with a time measuring device and several light barriers. The definitions ***average velocity*** and ***instantaneous velocity*** should be understood and discussed on this example. The different velocity course of the individual runners should also be discussed.

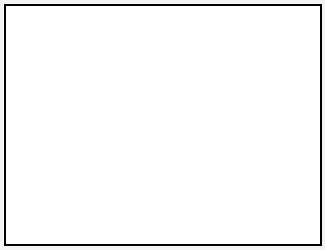
3 Methods and realization
3.1 Velocimetry
3.1.1 Average velocity and instantaneous velocity
Before carrying out any measurement on the sports ground the principle functionality of light barriers and electronic time peaces are explained. A chronograph enables exact time measurements. The pupils should help to set up and take down the measuring equipment and they should observe and record the measured values.
The chronograph is for measuring two times. The time measurement commences with the start signal. This also makes it possible that two runners compete with each other. In that case time of two behind the other placed light barriers is stopped. The start signal takes place loudly via a button in the commando box. There is also a button for false start and a reset button. Power is supplied through a built in 12 V- accumulator. The chronograph services up to three light barriers, whereby one is optionally used for the start signal and the others for the stop signals.
The light barriers are industrial light barrier apparatus with high precision and minimal sensitivity to light. The light barriers are installed on clamps and the reflectors can be mounted on any stand rods. The measurement data of the timing channels can be read out through a RS-232 interface for data transmission to PC.

3.1.1.1 Measurement of the running speed

The distance between the light barriers was 1 m during the first pass and was reduced to 20 cm in the second pass to get closer to an instantaneous velocity.

The left time indication shows the time (t1) from the start up to the passing of the first light barrier. The right time indication shows the time (t2) up to the passing of the second light barrier. The difference between the two measured values (t2 - t1) is the runtime for the measured distance of 1 m or 20 cm.

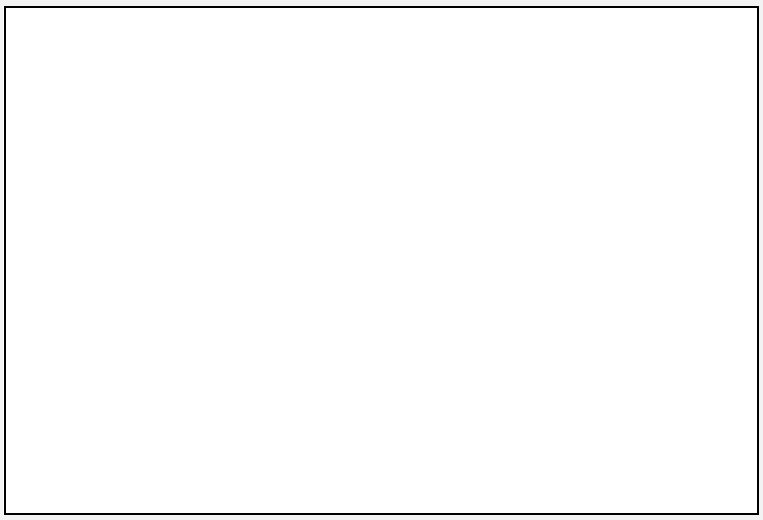




From the measured times the velocity can be calculated. This is of course only an average velocity for the selected distance. During the following after-meeting the difficulty to determine the instantaneous velocity was discussed.

3.1.1.2 Starting time and starting acceleration

Analogous to the measurements of the above described exercise the velocity of a runner was determined with a chronograph. This time the first measured time (start time t1) was also used for the calculation of the starting acceleration. The distance between the light barriers was 0,5m. The starting acceleration is resulting out of the starting time and the velocity. The measured values were set up in a spread sheet and the acceleration values calculated. Furthermore the results were compared to acceleration values of vehicles (see box below).

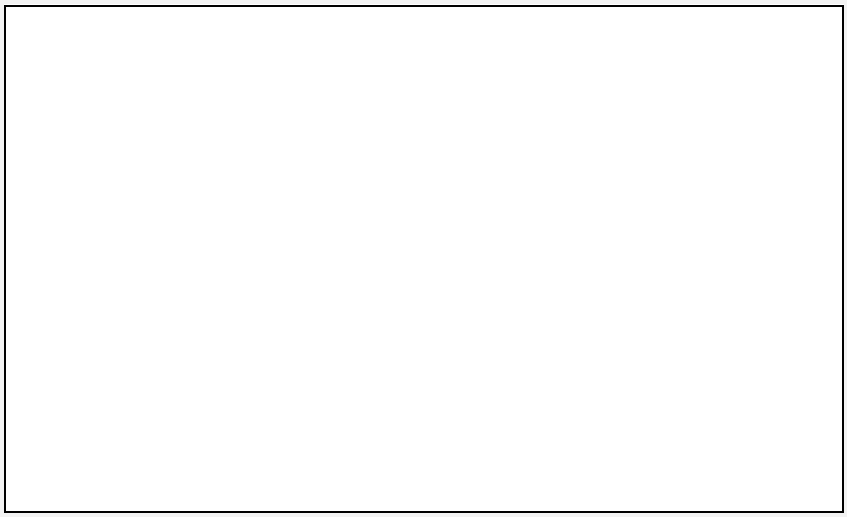


3.1.1.3 Velocity, acceleration and stopping distance while running

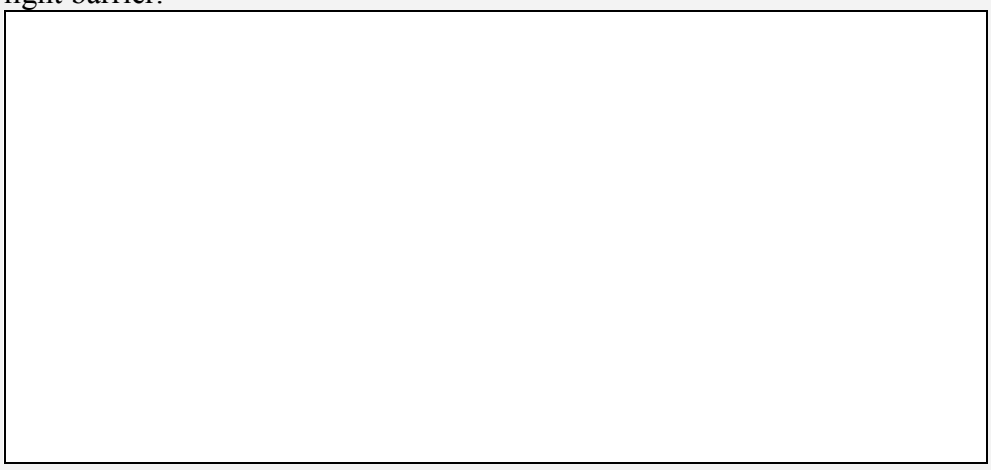
In addition to the velocimetry the stopping distance was determined. The pupils had to stop as quickly as possible after passing the second light barrier. The stopping distance was measured with a measure tape and from the measurement data (stopping distance, speed) the deceleration can be calculated.

3.1.2 Evaluation of speed and acceleration while running by video analysis
Videos shot by the pupils themselves of the 60 m sprint on the sports ground were evaluated using appropriate software. From the video sequence the starting time, starting acceleration and velocity were determined. For that in several images corresponding points (ear of the runner) were marked and the distances were measured. The time intervals of the marks are known from the number of images per second. At the end the pupils had to solve the same task (see 4.1.2)

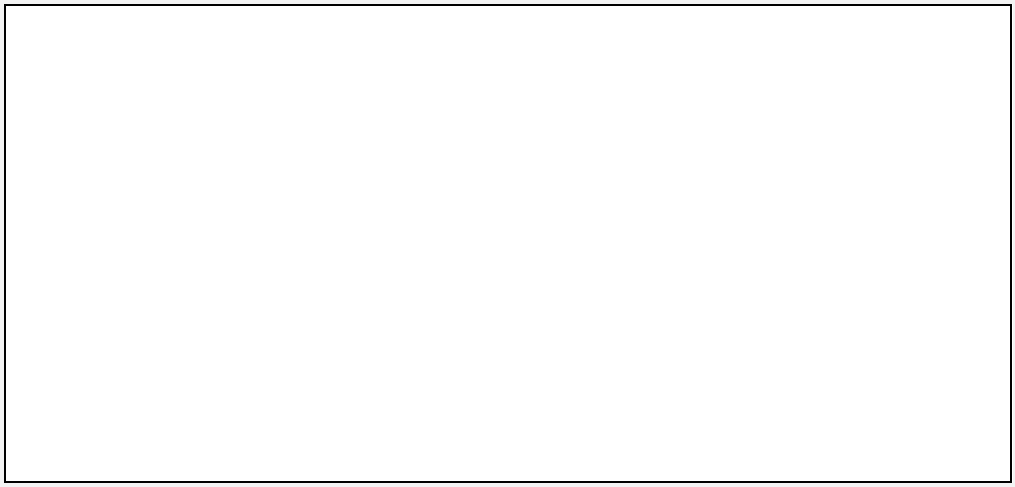
4 Results
4.1 Worksheets, solutions and tables for the velocimetry
4.1.1 Average velocity and instantaneous velocity
4.1.1.1 Measurement of the running speed
The results of time measurement and the calculated velocities are shown in the table below.



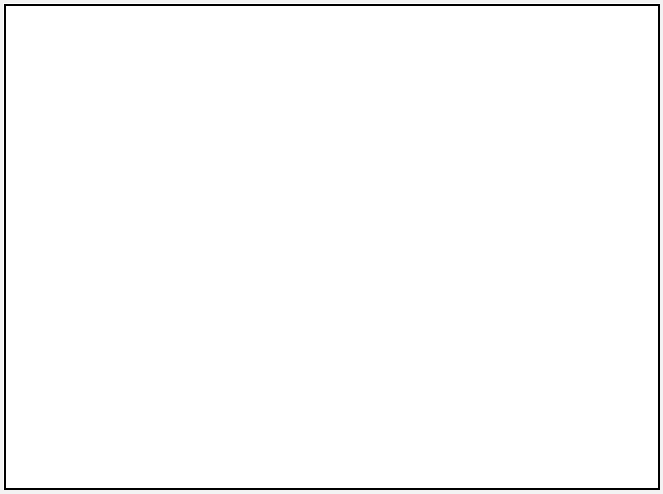
4.1.1.2 Start time and start acceleration
Calculation of the starting acceleration from velocity and time needed to pass the first light barrier.



4.1.1.3 Stopping distance and deceleration
After passing the light barrier the runners slowed down as quickly as possible.



4.1.2 Video analysis of a runner (Analysis with the programm Vidshell)
The standard was fixed with a known distance.



The five marks show the positions of the ear of the runner at the time t_1 to t_5.

In this worksheet all results of the pupils were listed in red.

Determine the instantaneous velocity v_1 (between pos. 11 and pos.12).

$v_1 = 0,12 / 0,04 = 3$ m/s = 10,8 km/h

Determine the instantaneous velocity v_2 (between pos. 29 and pos. 30).
$v_2 = 0,2 / 0,04 = 5$ m/s = 18 km/h

Determine the average velocity v_3 (between pos. 3 and pos. 30).
$v_3 = 3,61 / 1,08 = 3,34$ m/s = 12 km/h

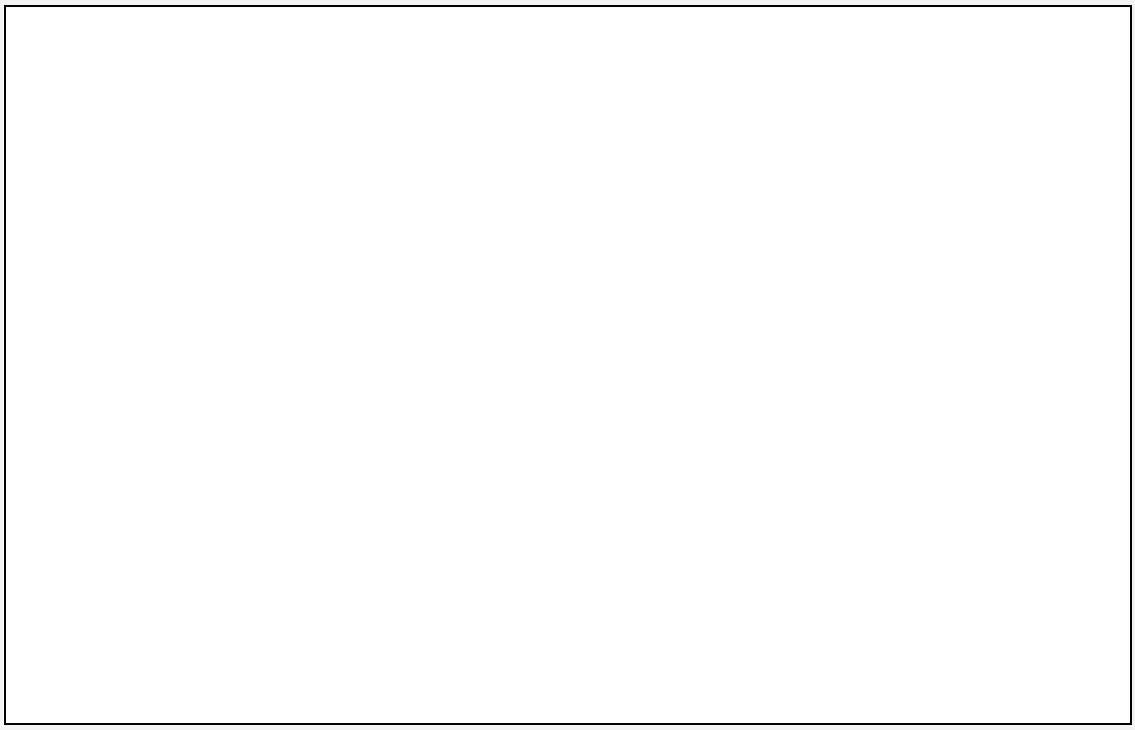
Determine the starting acceleration a_0.
$a_0 = 3 / 0,34 = 8,8$ m/s²

Determine the acceleration a_1 (runner after one second).
$a_1 = 5 / 1 = 5$ m/s²

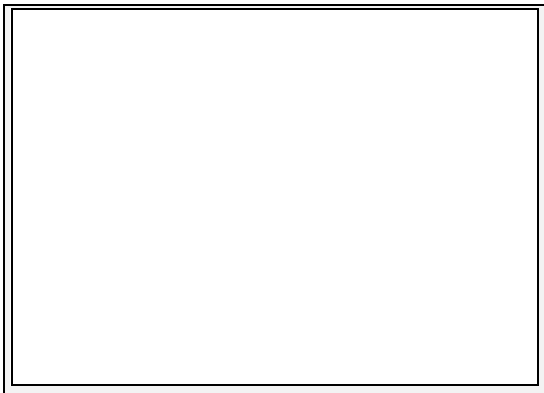
4.1.3 Average velocity in several stages of the run

Beside the spreadsheet with the average velocities in 10 stages of the 60 m sprint, also a list with the run times and the average velocities was set up and sorted by size.

Results of the run times of the 60 m sprint of 25 pupils. For one runner the run times and the velocities in 10 stages are shown and also the diagram with the speed values.



Velocities: 60 m sprint



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Additional exercises and trials, which can be conducted.

2.2 Vertical jump
2.2.1 Determining the jumping power
2.2.2 Force analysis during a vertical jump
2.2.3 Force analysis of motions

2.3 Long jump and high jump
2.3.1 Long jump with additional weights
2.3.2 High jump

RM3 17: Food digestion (IJS)

Translations of original activities: Food as fuel. Exercise groups 1&2.

Food as a Fuel
1st GROUP

1. Experimental exercise: What types of substances is food composed of? How can we determine those types of substances?

The goal of the experimental exercise:
In the exercise you will determine definite kinds of nutritive substances in a food.

The following reagents (solutions) will be used for that purpose:
Fehling`s reagent (e.g. http://en.wikipedia.org/wiki/Fehling%27s_solution)
Biuret reagent (e.g. http://en.wikipedia.org/wiki/Biuret_test)
and Iodine/KI reagent (e.g. http://en.wikipedia.org/wiki/Lugol%27s_iodine).

Table 1 shows what kind (type, group) of substances is determined with the reagents. Table 1 also shows what colour change should follow after addition of specific reagent into a sample if the sample contains this kind of substance.

Table 1

reagent	***BIURET REAGENT***	***FEHLING`S REAGENT***	***IODINE/KI SOLUTION***
Type of substance to be determined by the reagent	protein	monosaccharide	starch
Colour change to	violet	red – brown	deep blue

The course of the work:
1. On a platter you will find different food samples. If a sample is in a solid state crush it or mince it with a knife before you add water to a sample and then mix it in a plastic cup to get a solution. Don't forget to mark each sample on a cup.
2. Pour each sample into 3 test tubes at about three centimetres height (two fingers) and add:
-2 droplets of Biuret reagent into 1st test tube,
-2 droplets of Fehling's reagent into 2nd test tube and,
-2 droplets of Iodine/KI solution into 3rd test tube.
3. Test tube with Fehling's reagent should be slightly heated over the alcohol burner.
4. Table 2 is to be fulfilled with the following data:
- What was the food sample taken and dissolved in a plastic cup?
- Describe changes observed in test tubes after adding reagents.
- Note (yes or no) if some spot of grease was observed on a filter paper (see next test below).
- What type (kind) of nutritive substance(s) your food sample contains?

5. Several droplets of the solution in a cup pour onto a filter paper, labelled with a sample's mark and leave it to get dry. Enter your observations into Table 2 and decide upon the presence of fats (e.g. http://en.wikipedia.org/wiki/Fat) in a sample.
6. Repeat the same procedure (2.to 6.) with **all food sample solutions**, being prepared in cups (point 1). **Leave the remains in cups for the next experimet**

Table 2: Observations and results

Food sample	*Adding Biuret reagent*	*Adding Fehling's reagent*	*Adding Iodine/KI solution*	*Spot of grease on a filter paper (YES- NO)*	*What kind of nutritive substance(s) food sample contains?*

2. Experimental exercise: What occurs to food after ingestion?

The goal of the experimental exercise:
To determine types of substances that result in a digestion process (e.g. http://en.wikipedia.org/wiki/Digestion).
Capsules Kreon with digestive enzymes will be used (e.g. http://www.drugshoponline.com/Buy-Gastrointestinal-PANCRELiPASE-%28PANZYTRAT%29-%28KREON%29-25000-100-capsules.html or http://www.drugspro.org/stomach-disease/kreon.html).

In our body those enzymes are formed in a part of a body known as pancreas. After enzymes activity the reagents from the first exercise will be used to determine if samples of food were changed.
Kreon capsules contain a mixture of 3 enzymes (they are specific proteins): lipase to decompose fats (lipids), protease to decompose big molecules of proteins, and amylase to decompose starch.

The course of the work:

1. Two test tubes are labelled as B1 and B2. Into each pour 3 cm (two fingers) of the white of egg solution. Into test tube B1 add some droplets of Biuret reagent.
2. Four test tubes are now labelled S1, S2, S3, and S4. Into each pour 3 cm (two fingers) of the solution which contains starch. Into test tube S1 add some droplets of Iodine/KI solution and into test tube S2 some droplets of Fehling's reagent.
3. Two test tubes are labelled M1 and M2. Pour into each 3 cm (two fingers) of fat foodstuff.
4. Into test tubes B2, S3, S4, and M2 pour the solution of the medicine Kreon and put them in a beaker with water, heated to 37 ^{0}C, for 10 minutes.

5. When test tubes are taken out of water bath, add:
- Into B2 some droplets of the Biuret reagent
- Into S3 some droplets of the Iodine/KI solution
- Into S4 some droplets of the Fehling's reagent
- Into M1 and M2 universal indicator paper.

6. Describe your observations in the Table 1.

Table 3: Observations

Test tube	***Contents***	***Observations***
M1	Fat + indicator	
M2	Fat + Kreon + indicator	
S1	Starch + Iodine/KI solution	
S2	Starch + Fehling's reagent	
S3	Starch + Kreon+ Iodine/KI solution	
S4	Starch + Kreon + Fehling's reagent	
B1	Proteins + Biuret reagent	
B2	Proteins + Kreon + Biuret reagent	

Results

Compare colours in the test tubes B1 and B2. What are your conclusions using your observations?

Compare colours in the test tubes S1 and S3. What are your conclusions made from the comparison of these two test tubes?

Compare colours in the test tubes S2 and S4. What are your conclusions using your observations?

What is your conclusion observing colouring of the universal indicator paper in the test tubes M1 in M2?

Summary conclusions

What are your conclusions after the experimental exercise being carried out?

What you learned and recognized using this experimental exercise?

Food as a Fuel

2nd GROUP

1. Experimental exercise: What types of substances is food composed of? How we can determine those types of substances?

A task and a goal of the experimental exercise
Plan and carry out experiments to experimentally find out the following:

1. What types of substances in a food could be determined by using the following solutions (reagents): Fehling's reagent, Biuret reagent and Iodine/KI reagent?

2. Each reagent changes colour in the presence of a specific ingredient of the food. Which colour change determines which type of substance is in a food?

Use samples of food prepared on a platter.

Tips:
- Prepare solutions of samples of food first;
- Gently heat samples with added Fehling's reagent over the alcohol burner

Describe your plan and the course of the work:

Records of observations:

Results and a summary conclusion:

2. Experimental exercise: What occurs to a food after ingestion?

Introduction
In a process of a food digestion in the alimentary canal (or tract) big molecules of lipids (fats), proteins, and polysaccharides are decomposed to simpler molecules with the help of enzymes.
It is the hydrolysis type of a chemical reaction (or decomposition) which is in the opposite (reverse) direction as when lipids, proteins, and carbohydrates are formed.

For better understanding examine in a group a **schematic poster**, explain it and discuss it in a group.

The medicine Kreon is composed of a **mixture of digestive enzymes of pancreas** to decompose fats (enzyme lipase), proteins (enzyme protease) and starch (enzyme amylase). Normally those enzymes are formed in the body. But some people with low function of pancreas need to take them as a medicine and Kreon is one such products.

The task:

How would you experimentally verify the influence of Kreon on decomposition of fats, proteins, and starch? Plan and carry out experiments to prove the activity of Kreon.

Suggestions:

1. Dissolve the contents of capsules in an acid. Namely, when ingested capsules arrive in the stomach with an acid environment.
2. Enzymes form and are effective at the body temperature (36-37 °C). Therefore the same conditions are to be provided. So, test tubes with samples and Kreon are to be immersed into water bath at about 37 ^{0}C.
3. Think over which products are formed in decomposition (hydrolysis) of fats, starch, and proteins. How could they be determined (proved).
4. Show your work plan to the teacher before you start experimenting.

Describe your plan and the course of the work:

Records of observations:

Results and a summary conclusion:

Translations: Fat synthesis (English)

Teaching materials for IPs adapted by UFRJ

UFRJ 1: Biodiversity in the Caribbean Sea (CINVESTAV)
Outline teaching sequence:
-Draft of adapted IP by UFRJ.

UFRJ 2: Acting instead of talking (UZH)
Outline teaching sequence:
-Draft of adapted IP by UFRJ.

UFRJ 3: Invasive species (USC)
Outline teaching sequence:
-Draft of adapted IP by UFRJ.

UFRJ 4: X-rays (UZH)
Outline teaching sequence:
-Draft of adapted IP by UFRJ.
-See also materials at AIE and USC section.

UFRJ 5: Science across the world (LSBU)
Outline teaching sequence:
-Draft of adapted IP by UFRJ.

UFRJ 1: Biodiversity in the Caribbean Sea (CINVESTAV)

Outline teaching sequence: Biodiversity (fisrt draft)

An educational programme for the conservation of biodiversity and for raising awareness about environmental impact in ecosystems strongly afftected by pollution

Adapted from CINESTAV's IP "Biodiversity in the Caribean Sea".

First Draft, November 2010.

Adaptation team:
School teachers: [Teacher 1] and [Teacher 2]
University researchers: [Researcher 1], [Researcher 2] and [Researcher 3]

Implementation will take place between March and June/2011

Objectives:

a) To develop a socio-environmental diagnosis in an ecosystem which ia geographically close to the school (e.g. lake or Atlantic forest park).

b) To interview members of both the educational and social communities about selected aspects identified in the environmental diagnosis

c) To produce informative and educational materials as well as educational activities in order to inform the community about the results of the socio-environmental diagnosis;

d) To establish partnerships with local health authorities and environmental authorities in order to maximise resources and efforts;

e) To raise awareness about the environmental impacts suffered by the ecosystem.

f) To develop activities in order to promote critical emancipatory education through partnerships between the school and local health and environmental authorities, through (i) the participation of the community in pre-existing projects in the municipality related to Health and/or Environmental as well as (ii) the increased interaction between the school and representatives in the local parliament.

Initial Activities

1st week: Preparatory activities seeking to raise students' awareness toward environmental issues including (i) reading activities of selected texts about water and soil pollution and their relationship with issues as biodiversity, environmental questions and human health, (ii) walks around the ecosystems guided by both the Geography and Biology teachers to observe environmental features and aspects concerning pollution.

2nd week: Compilation of observations and problematisation of selected features. Research of relevant topics in order to deepen their understanding.

3rd week: Elaboration of a questionnaire and of an interview protocol to be conducted with students, teachers, parents, members of the community in general, health professionals (e.g. in the context of the diagnosis about socio-environmental impacts in a local lake, to conduct interview local fishermen about the availability of different fish in the lake, about how it has been to fish in the lake waters for the last years).

4th week: Analysis of the results of questionnaire and interview students

5th week: Elaboration of educational materials (leaflets and fliers) to be handed out to the community as a whole addressing the issues identified in the diagnosis. This should incorporate the different perspectives of the interviewees and includes descriptions of problems as well as to identify and suggest possible solutions.

6th and 7th week: Elaborate and rehearse a school play to communicate their results for the school community.

8th week: To conduct an evaluation activity of the experience in order to think about ways to reach out for the representatives in the local parliament to present and discuss their results as well as to plan future implementations.

Alterations
- teachers workshops were deemed not necessary.
- sensibilisation/awareness raising activities (e.g. through reading) were introduced
- change in the original ecosystem to be studied was justified by the proximity of other ecosystems and the school
- activities were adapted to work with students in 12 to 16 YO age range.
- the creation of partnerships between teachers in school (e.g. Biology, Geography, Arts and Language) is fostered in.

UFRJ 2: Acting instead of talking (UZH)

Outline teaching sequence: Acting instead of talking (fisrt draft)

Adapted from UZH IP "Acting instead of talking".

First Draft, November 2010.

Adaptation team:
School teachers: [Teacher 3] e [Teacher 4]
University researchers: [Researcher 1], [Researcher 2], [Researcher 4].

Implementation will take place between March and July/2011

Objectives:
a) To raise awareness and to develop critical thinking about decreasing emissions of greenhouse gases and its effects on agriculture.
b) To foster the development of competencies in inquiry and collaborative work, argumentation, decision making and autonomy.

Initial Activities
- Screening of "Climatic changes" (Brazilian Institute of Airspace Research video production) and of Al Gore's movie "An Inconvenient Truth": students are presented to

the problem sustainability and fill in a work sheet. A discussion of the answers in class follows.
- Students read and discuss in groups different articles about environmental problems, write an abstract and a conclusion, and present them to the class.
- Discussion in class about sustainable development and possible ways to contribute individually in everyday life. Teacher suggests two topics: saving water and saving electricity at home and in the school.
- For the selected topics, students collect ideas for actions that would contribute to a sustainable development and possibilities of implementation at different levels (individually, class, school, community).

New Activities
- A Brazilian video about the topic was included so as to increase students' motivation.
- Students decide in groups on which ideas they want to realise. Students build groups and prepare the implementation of specific actions. For the examples above, students contact people in the school (headmaster, janitor, teachers, other students etc) and do a survey and a check out visit in order to evaluate use/waste of water and energy in the school. They do the same in their homes. They produced a PowerPoint presentation summarizing the most important points and the problems they discovered and how the use of water and energy can be reduced at home and in school.
- Simulation of greenhouse gases effect by building a terrarium and evaluate how water and energy sustainable use can reduce this effect.
- Working together with Physics and Biology teachers, students develop a way of measuring how much water and energy has been saved during the project extend (first in the class and after in the hole school). Experimental gadgets may be developed in order to test the possibilities of measuring the amount saved at home and/or school. These results may be used in science class to work on topics like dynamics of fluids, electricity, etc.
-Writing activities in order to produce multimodal educational materials for the community were introduced.
- At the end, students will organise an event ("Ecology and Environment Week") for the community and distribute the educational materials they produced.

UFRJ 3: Invasive species (USC)

Outline teaching sequence: Invasive species (fisrt draft)

Adapted from USC IP "Invasive Species".

First Draft, November 2010.

Adaptation team:
School teachers: [Teacher 5]

University researchers: [Researcher 1], [Researcher 2], [Researcher 5].

Implementation will take place between March and July/2011

Objectives:

a) To raise awareness and to develop critical thinking about the relationship between the presence of invasive species and biodiversity, including possible risks to human health.

b) To visit areas near to school where there are invasive species (African Snails) to develop field work and reports.

c) To develop research about African Snails using different textual genres, eg. scientific, newspapers and magazines.

d) To produce informative and educational materials to provide the local community with information of the results of their research and field explorations.

e) To develop critical education through stimulating relationships and partnerships between school community and local residents' community.

Initial Activities

March

+ Preparatory activities, seeking to raise students' awareness toward environmental and health issues associated with the presence of the African snails, will be carried out. They will include (a) watching a video about the topic (b) debating and discussing between students about the theme of the video.

+ Students will conduct literature research (printed materials and internet sources) about African snail and about topics such as biodiversity and the effects of introducing non-native species in ecosystems.

+ Students will conduct field work in areas infested by African snails to know the place, including environmental problems and possible risks to human health.

+ There will be discussions in the classroom about the visit and elaboration of field reports.

April

+Students will do further research on the topic and select different types of texts.

+ There will be discussions in the classroom about both the content and formats (generic features) of the different texts selected by students.

+ Students will develop and take part in reading activities, preparation of abstracts and reviews, debates, group discussions etc. in order to increase reading, writing and argumentation skills and to evaluate reliability of information.

May and June

+ Students will have a final opportunity to gather any further information that might be needed to complete their research.

+ Students will elaborate educational materials (e.g. booklets, leaflets and fliers) to communicate the results of their research and field work for the school community and local community.

+Students will engage in writing activities in order to produce texts according to the demands of different reading situations and practices. Features such as characteristics of the target audiences as well their interest and need for information will be considered. This stage will include practices of writing, drawing, selecting images, organize the lay-out of the pages, and other tasks necessary for accomplishing the demands to produce a multimodal texts.

July

+ Students will organise an event for the community and distribute the educational materials they produced.

Alterations

- A video about the topic was included so as to increase students' motivation.
-Writing activities in order to produce multimodal educational materials for the community were introduced.
- A specific invasive species (African Snails) was identified in order to recontextualse the IP to the Brazilian reality and to address a problem that already exists in the community.
- Activities were adapted to work with students in 10 to 12 YO age range.

UFRJ 4: X-rays (UZH)

Outline teaching sequence: X-rays (first draft)

X – Rays – Articulating contents of physics, chemistry and biology
First Draft, October 2010

Adaptation of the Innovative Practice UZH "X-rays – a combination of physics and human biology/medicine", of ETH competence centre for teaching and learning (Swiss Federal Institute of Technology).

High school Teacher:
[Teacher 6], (Rio de Janeiro)

UFRJ Researchers (Kids INN Science)
[Researcher 1], [Researcher 2].

It will be implemented in the schools in March 2011.
Students' age range 12 to 14 years old.

Objectives:

a) To understand the electromagnetic spectrum and the possibility to see different colors;

b) To observe that electromagnetic radiation allows us to visualize the bones or any of the organs of the human body;

c) To understand that these radiations are propagated by electromagnetic waves.

d) To connect daily experiences of students with science content, teaching through proposals based on research.

e) To develop models of teaching and interdisciplinary learning.

f) To explore links between health education and science education

g) To develop links between physics education and environmental education

h) To explore the potential of activities involving History of Science in order to explore relevant aspects of teaching about the nature of science.

Initial Activities

+ Introduction

- Students talk about their experiences with X-rays and x-ray images.
- Students formulate their own questions about light, x-rays, and their medical applications, such as how a doctor could diagnose a fracture before an radiography is performed.

+ Visible and invisible light

-Definition and conceptualisation of UV rays, radio waves, x-rays, including the risks of radiation and x-rays.

- Students research the profile of William C. Rontgen and discuss aspects related to the discovery of x-rays

+ Building a model of an x-ray machine

- Discuss the analogy between images formed by shadows cast through the exposure of opaque objects to visible light and X-ray images.
- Students build a model of x-ray machine.
- Students produce their own images of x-ray drawing the shadows, drawing the parts of a skeleton on a sheet of paper. (Positive film in contrast to the negative film image of an x-ray)

+ Shadow images / patterns of X-ray

- Explore the question of why not use X-ray to produce images of internal organs?

New Activities

+ First Lesson: Irradiation

Classroom discussion following presentation of the electromagnetic spectrum. Explanation of differences and provision of everyday examples of ionising and non-ionising radiations. Activities to support students learn how to differentiate radiation and irradiation; Analysis of characteristics of sunscreens based upon information available in labels.

+ Second Lesson: Electromagnetic radiation

Exploration of the concept of electromagnetic waves; Recollection of activities already done (e.g. Newton's disc); Establishing relationships between X-rays and other different wavelenght radiations; Students show X-rays images they have collected at home or over the internet.

+ Third Lesson: X-rays, what are they?

Students will present research they will have done about the “discovery” of X-rays; Discussion of aspects of history and nature of science discussed (nature of science, serendipity...). Discussion about atomic structure.

+ Fourth Lesson: X-rays: what are they? (follows sequence in the original IP)
Building a model of an x-ray machine

- Discuss the analogy between images formed by shadows cast through the exposure of opaque objects to visible light and X-ray images. Students build a model of

x-ray machine. Students produce their own images of x-ray drawing the shadows, drawing the parts of a skeleton on a sheet of paper.

+ Fifth lesson:

-Explore issues concerning atomic structure; Understanding how X-rays affect living organisms; Lecture with health professional and/or medical physicist (specialist in radioprotection)

+ Sixth Lesson:

-Environmental issues: students will report on research they will have done about methods to extract silver from used X-ray plates in the context of recycling and about treatment of residue of chemicals used in the development of X-ray plates..

+ Seventh lesson: Construction of a solar collector (OPTIONAL)

-Expanding on knowledge about electromagnetic radiation. Possible links with other topics in the curriculum

-What is a solar colector?

-Water is heated.

UFRJ 5: Science across the world (LSBU)

Outline teaching sequence: Science across the world (first draft)

Science across the world

Adaptation of the Innovative Practice of LSBU – England "Science around the globe".

First Draft, November 2010.

Professoras do Ensino Fundamental do 2º ciclo:
[Teacher 7], [School A], Rio de Janeiro.
UFRJ Reseachers (Kids INN Science)
[Researcher 1] e [Researcher 2]

kidsINNscience Brazilian-UFRJ Team
[Researcher 3], [Researcher 6], [Researcher 5], [Researcher 4], [Researcher 7] e [Researcher 8]

Implementation would start in March-2011. To be worked with 15-17 years-old students.

Objectives:

a) help develop both self and other cultural awareness and foster the discovery of differences and similitudes in the approach to socio-scientific issues and in views of science across different countries when compared to local context;

b) help widen world views and foster comprehension and tolerance amongst people;

c) promote digital inclusion in a given context and stimulate collaborative work amongst students from different cultural, economic, ethnic and religious backgrounds;

d) stimulate cooperation and cultural exchange amongst students from Portuguese and non-Portuguese speaking countries.

Initial Activities (these are kept or slightly modified from the original IP)

Project presentation – Students are presented to the project. Existent experiences are displayed and criteria for participation and evaluation are explained. Students are presented to the project's webpage and to the software (MSN, ICQ, Googletalk etc) and hardware that will be used during the project.

Topic of the project presentation – students are presented to a topic previously selected by the teachers. Teachers of different disciplines (History, Geography, Chemistry, Physics, Biology, Portuguese, English, Spanish) are supposed to take part in topic selection and in the development of related activities. The activities are presented and students are asked to take part in them. The assignment of activities should capitalise on students' interest and proficiency in IT skills and/or in foreign language expression. The first contacts with foreign students should start after this activity.

New Activities

Teaching activities and scientific concepts – each and every participant teacher elaborates a lesson on a theme that is related to the chosen socio-scientific topic and to science knowledge. This class and theme should address some content in the regular curriculum.
Example: Topic – Acid rain. History – Industrial Revolution. Geography – Air pollution. Chemistry – Chemical reactions, chemical functions. Physics – thermodynamics. Biology – Environmental damage, health problems caused by pollution. Portuguese, English, Spanish – vocabulary and written expression skills in these different languages.
Research activities – students will visit their community and local industrial plants and/or other sites linked to different enterprises in the productive chain in order to investigate local environmental issues and conduct interviews. The data gatheredwill be exchanged with their foreign colleagues. They will also research about the culture and socio-scientific problems that are relevant in the countries in which their foreign colleagues live.
Review and report activities – Students present the results of their research and of the project both to the school and local communities. They produce different textual/visual materials in the different languages they have got in contact with. These materials will be exposed during the report activities.
In situations where the involvement of Foreign Language teachers would not be possible, teachers proposed to conduct a "Science across Brazil" project, exploring cultural, economical and environmental diversity within Brazil.

Teaching materials for IPs adapted by USC

USC 1: Potatoes don't grow on trees (RM3)

Outline of teaching sequence (Galician and English):

-*¿De onde saen as patacas?* (3 pages outline in Galician of the adaptation prepared in the USC in collaboration with teachers).

-*Where do potatoes come from?* (Translation to English of the 3 pages outline by USC).

-See also comments at LSBU 1 section.

USC 2: X-rays (UZH)

Outline of teaching sequence (Galician):

-Raios X (2 pages outline in Galician of the adaptation prepared by the teachers).

-See also AIE and UFRJ section.

USC 3: Eye and optics (UZH)

Original paper (German):

- Brovelli, D., Wilhelm, M. (2009). Problemorientiertes Lernen für den integrierten Naturwissenschaftsunterricht. Vorschläge für Unterricht zur Optik und Akustik. *Physik und Didaktik in Schule und Hochschule* 2/8/2009, pp. 65-72. Download link: http://www.phydid.de/index.php/phydid/article/view/70/Artikel%2070

Support documents (German):

- Problembasiertes Lernen (PBL) als Ansatz zum Kompetenzerwerb bei fächerübergreifenden naturwissenschaftlichen Themen. PPT by Dorothee Brovelli and Wilhelm Markus, PHZ Luzern.

USC 4: Science Blogs (UFRJ)

-See also comments at CINVESTAV 4 section.

USC 1: Potatoes don't grow on trees (RM3)

Outline of teaching sequence: De onde saen as patacas? (Galician)

¿De onde saen as patacas?
Borrador 1, Outubro 2010

Profesoras de Educación Infantil:
[Teacher 1], [Teacher 2] (CEIP Pío XII, SC), [Teacher 3] [School A], [Teacher 4] [School B], [Teacher 5] [School C], [Teacher 6] [School D], [Teacher 7] [School E].

Investigadores USC
[Researcher 1], [Researcher 2] (Proxecto kidsINN Science)

Adaptación da Práctica innovadora de Roma 3 "As patacas non medran nas árbores", de Annastella Gambini, Universidade de Milán.
Comezará a levarse á aula en Xaneiro 2011, aínda que se plantarán máis tarde.

Obxectivos:
a) familiarizar aos nenos e nenas coa diversidade dos seres vivos, promover o respecto por todas as formas de vida e actitudes de conservación
b) Favorecer que participen no traballo experimental, a indagación
c) Que os nenos e nenas aprendan algúns conceptos básicos sobre as partes dunha planta como a pataca, as características dos tubérculos, o seu crecemento
d) desenvolver a transformación dun obxecto da vida diaria, 'a pataca', nun obxecto cultural, sobre o que se pode reflexionar xuntos e compartir experiencias, como plantar patacas e velas medrar.
A estes engadimos, no caso de Galicia:
e) poñer de manifesto o importante papel das patacas en Galicia, tanto na alimentación e gastronomía, como no folclore, cancións e contos, e na economía.
f) Valorar a calidade da "pataca galega".

Actividades iniciais (a parte que se mantén do orixinal)
– *¿Que ideas teñen os nenos e nenas sobre as patacas?*
(a expectativa é que o alumnado das escolas situadas en zonas máis rurais teñan coñecementos máis apropiados que os de zonas urbanas)
– *¡Cantas patacas distintas!*
Cen patacas (no orixinal usan 300) de distintos tipos, cores e procedencias, no piso do ximnasio ou da aula máis grande da escola. Xogo e exploración, identificación das diferencias, escoller algunha para as seguintes actividades.
Fotos de distintos tipos de patacas en Bolivia [Researcher 1] e da web.
– *Debuxar a pataca* e poñerlle nome á escollida. Discusión sobre a diversidade.
– *Facer carimbos* con patacas, debuxando figuras nelas.
– *Plantar patacas* na horta da escola e observar o seu desenvolvemento: isto levarase a cabo en primavera.

Actividades novas
– *¿Que cancións e contos coñecemos das patacas?*
Por exemplo 'Arroz con chícharos / patacas novas'; en castelán 'El corro de la patata'

– *¿Que é o que nos alimenta da pataca? O amidón e o seu recoñecemento*
Práctica de recoñecemento con Lugol (o amidón toma unha cor azul-violeta). Pódese esmagar unha pouca pataca, botar lugol e quentar / enfriar. ¿Que pasa?
Os alimentos máis importantes para os seres humanos: trigo, arroz, millo e pataca.
¿Será posible preparar algunha receita sinxela?
– *¿Qué é o que mantén pegada a tortilla de patacas? O amidón e as súas propiedades*
Actividade de fabricación de engrudo. Nas aldeas antes non había pegamento, frotábanse dous papeis cunha pataca cortada cando se querían pegar. Fabricamos engrudo pelando unha pataca, triturándoa en cru (por exemplo cunha minipimer) ou relándoa, e poñéndoa nun matraz de laboratorio. Engádese auga e axítase ben. Fíltrase (cunha tea ou con papel de filtro) para eliminar os fragmentos de pataca. Despois déixase repousar o líquido até que o amidón se deposite no fondo. Decántase, eliminando a meirande parte da auga. Dunha pataca grandiña (duns 250 g) obtéñense máis ou menos 50 g (comprobar) de amidón. Se a eses 50 g se lle engaden, primeiro uns 20 ml de auga para disolvelo en frío, e despois 180 ml (en total 200 ml, un vaso) e se ferve, sen deixar de remexer, obtemos engrudo. Se se quere menos espeso, poden engadirse outros 200 ml. (Tamén se pode facer engrudo de fariña, máis fácil, unha parte de fariña, 10 de auga). Pode usarse para facer algún obxecto de papel maché.
– *¿De onde proceden as patacas? A 'papa'*
Escribir un conto [Researcher 1], sobre uns nenos do Altiplano de Perú ou Bolivia. 'Papa' é unha palabra Quechua. Como foi domesticada hai 7000 anos perto do lago Titicaca. Traída polos españois, primeiro a Andalucía, onde se cultiva a mediados do século XVI. En 1574 usada para a alimentación no Hospital de Pobres de Sevilla nun episodio de fame. A historia de como Antoine Parmentier no século XVIII a populariza en Francia, despois de ser alimentado con elas (a comida do gando) sendo prisioneiro dos alemáns durante a guerra. Parmentier pon soldados para gardar o campo e retira a vixilancia pola noite para que a xente a roube.
– *¿Comemos unha planta velenosa?*
A pataca contén sustancias tóxicas nas partes que non comemos. Outros parentes da pataca que son velenosos, herba moura etc.
– *¿Que outros compoñentes existen na pataca*? ¿Que pasa cando poñemos unha pataca en auga osixenada? *¿Que son esas burbullas*?
A pataca ten unha substancia (catalasa ou peroxidasa) que cataliza a descomposición da auga osixenada H_2O_2 en auga e osíxeno. As burbullas son de osíxeno.

Outline of teaching sequence: *Where do potatoes come from?* (English).

Where do potatoes come from?
First Draft, October 2010

Kindergartern Teachers:
[Teacher 1], [Teacher 2] (CEIP Pío XII, SC), [Teacher 3] [School A], [Teacher 4] [School B], [Teacher 5] [School C], [Teacher 6] [School D], [Teacher 7] [School E].

USC Researchers (Kids INN Science)
[Researcher 1], [Researcher 2]

Adaptation of the Innovative Practice of Roma 3 "Potatoes don't grow on trees", of Annastella Gambini, Università degli Studi Milano, Italy.
It will be implemented in the schools in January 2011, although the potatoes will be planted later.

Objectives:
a) To immerse children in an educational context placing them in front of diversity of living beings; to foster respect for all living creatures and conservation attitudes.
b) To engage children in practical experiences, and inquiry.
c) To support children's learning some basic concepts about the parts of a plant like potato, their development and growth, the characteristics of tubers.
d) To transform an everyday object, the "common potato", into a cultural object on which to reflect, discuss together, organize other experiences, as planting potatoes and seeing them grow.
To these we add, in the case of Galician schools:
e) To highlight the important role of potatoes in Galicia, in food and gastronomy, as well as in folklore, songs and stories, and in economy.
f) To value the quality of the "Galician potatoe".

Initial Activities (these are kept or slightly modified from the original IP)
– *What ideas do children have about potatoes?*
(the expectation is that pupils from schools in rural areas have more appropriate knowledge, compared with pupils from cities)
– *How many different potatoes!*
A hundred potatoes (in the original IP 300 are used), of different type, colour and origin, are arranged on the floor of the Gymnastics hall or the largest room in school. Through free play and exploration, children identify the differences among them, they choose one for the subsequent activities.
Photographs of different potatoes types in Bolivia [Researcher 1], and in the web.
– *Drawing a potato* and naming their chosen potato. Debate about diversity.
– *Making stamps* with potatoes, drawing in them.
– *Planting potatoes* in the school vegetable garden, observing its growth and development: this will be carried out in spring.

New Activities
– *Which songs and stories do we know about potatoes?*
For instance in Galician '*Arroz con chícharos / patacas novas*' (Rice with peas / new potatoes); in Spanish '*El corro de la patata*' (Ring-a-ring-a potatoe).
– *What is that is feeding us in potatoes? Starch and its identification*
Practical experience of starch identification with Lugo's iodine solution (starch takes a blue-violet colour). Children may mash a part of a potato, to add Lugo and to heat / cool. What happens?
The four more important vegetables for human food are: wheat, rice, corn and potato.
Would it be possible to prepare a simple recipe?
– *What is that keeps stuck the potatoes in a Spanish omelette (tortilla de patacas)? Starch and its properties*
Activity: making potato paste (*engrudo*). In villages some time ago there were no commercial glue; when children wanted to stick drawings, they would apply a sliced potato to the paper. We make paste peeling a potato, mashing it raw (for instance with a mixer) or grating it, then putting the mashed pulp in an Erlenmeyer (or glass container).

We add some water, shake it and filter it (with a piece of cloth or filter paper) in order to eliminate the potato fragments. We let the liquid rest, until starch is deposited in the bottom of the glass. Decanting it, we eliminate most water. Of a regular-sized potato (about 250 g) we will get about 50 g starch (test it). To these 50 g we add, first about 20 ml water, to solve it while cool, then about 180 ml (in all 200 ml, about a glass) and we boil it while stirring it, we will get paste. We can make it with more water (another 200 ml) to make it less thick. (Another possibility is to make wheatpaste, it is easiest, one part of flour, 10 parts of water). We may use it to build an object of paper-maché.
– *Where do potatoes come from? The 'papa'*
Write a story [Researcher 1] about children in the Peruvian or Bolivian Altiplano. 'Papa' is a Quechua word. How it was domesticated 7000 years ago close to lake Titicaca. It was brought to Europe by the Spaniards, first to Andalucía, where it began to be cultivated in the middle of 16th century (and is still called 'papa'). In 1574 it was used to feed interns in the Poor's Hospital in Sevilla during a famine episode. The story of Antoine Parmentier in the 18th century, he made potatoes popular in France, after eating them (it was cattle's feed) while prisoner of Germans during a war. Parmentier places soldiers to keep the field where potatoes were growing, but takes out the guards at night enticing people to steal them.
– *Do we eat a poisonous plant?*
Potatoes contain toxic substances in the parts that we do not eat. Other potato relatives that are poisonous.
– *Which other components do have potatoes*? What happens when we put a little piece of potato in oxygenated water (Hydrogen peroxide)? *What are these bubbles*?
Potatoes have a substance (catalase or peroxidase), which catalyzes the decomposition of oxygenated water H_2O_2 (commonly used in schools to disinfect small injures) in water and oxygen. The bubbles are oxygen.

USC 2: X-rays (UZH)

Outline of teaching sequence: Raios X (Galician)

kidsINNscience:
X-rays – a combination of physics and human biology/medicine

DATOS INICIAIS:

CENTROS:
[High School A] – [Teacher 8]
[High School B] – [Teacher 9] E [Teacher 10]

CONTEXTO:
ALUMNOS E ALUMNAS DE DIVERSIFICACIÓN CURRICULAR

MATERIA:
ÁMBITO CIENTÍFICO-TECNOLÓXICO

ASPECTOS METODOLÓXICOS:
Dado o tipo de alumnado, con carencias cognitivas, falta de hábito de estudo e baixa autoestima, establecemos as seguintes consideracións:

+ achega de baixo perfil conceptual e con forte compoñente actitudinal
+ temporalización flexible dado o elevado número de horas semanais
+ secuenciación adaptada ao resto da programación

CONCRECIÓN DA ADAPTACIÓN.

1. Ideas previas.

Mediante test escritos e debate na aula poñeremos de manifesto o coñecemento que os alumnos e alumnas posúen sobre "a radiación" en xeral, e sobre os R-X en particular . Indagaremos cales son os erros conceptuais presentes e veremos como orientar as actividades para correxir esas concepcións erróneas.

2. Actividades propostas

a) "As luces invisibles". Mediante o uso dunha cámara dixital (a dunmóbil, por exemplo), poñeremos de manifesto a existencia da luz "invisible" que emite a distancia. Despois buscaremos en libros de texto de secundaria como se chaman outros tipos de radiiación (IR, UV, Microondas, R-X …)

b) "Separando os diferenes tipos de luz". Cunha rede de difracción constataremos que a luz emitida por diferentes dispositivos (luz solar, tubos fluorescents, lámpadas de incadescencia, led's, etc) están formadas por diferentes tipos de luz

c) "Caracterizando as radiacións". Introducimos de forma cualitativa como parámetro distintivo a lonxitude de onda, establecendo a súa relación inversa coa enerxía da radiación. En bae a isto, faremos ionsideracións sobre as especiais propiedades dos R-X.

d) "Aproximación aos R-X". Iluminamos con fonts de luz intense partes do noso corpo como os dedos da man ou as orellas para comprobar como a luz pode atravesar parcialmente a nosa piel "amosando" o que hai debaixo. Realizamos a iluminación dun modelo de corpo humano para simular como fan os Raios X. Con radiografías traidas por eles analizaremos algunhas das súas características a partir dos coñecementos xa adquiridos.

e) "A nosa actitudes". Discutiremos a importancia dunha cultura da prevención en termos de saúde, tomando como exemplo a realización de mamografías, revision no dentista, e tamén evitando os excesos nos baños de sol durante o verán. Podemos aproveitar esta actividade para tamén achegar cuestións como a do custo das radiografías en particular, e o gasto medico-farmacéutico en xeral.

f) "Unha breve revision histórica". Realizar unha pequena investigación de como ten cambiado o uso dos Raios X en medicina na nosa comunidade.

g) "Verdades e mentiras". Achegamento crítico ao tratamento que desde series de TV se fai das actividades desenvolvidas nun hospital: "Hospital Central", "House", "Urgencias", "Anatomía de Grey", etc.

AVALIACIÓN DA PROPOSTA.

Refaremos en parte algún dos test escritos iniciais que nos permitiron descubrir as ideas iniciais dos alumnus e alumnas e realizaremos un debate que poña de manifesto o grao de aprendizaxe a partir das actividades desenvolvidas.

Teaching materials for IPs adapted by UZH

UZH 1: Potatoes don't grow on trees (RM3)

-See teaching materials adapted by USC.

-See also comments at LSBU 1 section.

UZH 2: Cooking with the sun (USC)

-See teaching material for IJS 5.

UZH 3: Physics and sports (AIE)

-See teaching material for RM3 14.

UZH4: Science blog (UFRJ)

-See also comments at CINVESTAV 4 section.