<table>
<tr><th>DATE</th><th colspan="11">PLENARY LECTURES, WORKSHOPS, ORAL AND POSTER PRESENTATIONS AND SOCIAL ACTIVITIES</th></tr>
<tr><td>SUNDAY JULY, 6</td><td colspan="4">16:00 - 18:00
REGISTRATION</td><td colspan="2">18:00 - 18:30
PL 1</td><td colspan="5">19:30 - 21:30
WELCOME COCKTAIL</td></tr>
<tr><td rowspan="2">MONDAY JULY, 7</td><td colspan="2" rowspan="2">9:00 - 11:00
PL 2
PL 3</td><td rowspan="2">11:00 - 11:20
COFFEE</td><td rowspan="2">11:20 - 12:40
ORAL PRESENTATION</td><td rowspan="2">12:40 - 13:40
LUNCH</td><td>13:40 - 14:40
PL 4</td><td>14:40 - 16:00
ORAL PRESENTATION</td><td>16:00 - 16:20
COFFEE</td><td>16:20 - 18:00
ORAL PRESENTATION</td><td rowspan="2">18:00 - 19:00
POSTER PRESENTATION</td><td rowspan="2">20:00 - 22:00
CONFERENCE DINNER</td></tr>
<tr><td colspan="4">14:00 - 16:30
WORKSHOP 1</td></tr>
<tr><td rowspan="2">TUESDAY JULY, 8</td><td>9:00 - 10:00
PL 5</td><td>10:00 - 11:00
ORAL PRESENTATION</td><td>11:00 - 11:20
COFFEE</td><td>11:20 - 12:40
ORAL PRESENTATION</td><td>12:40 - 13:40
LUNCH</td><td>13:40 - 14:40
PL 6</td><td>14:40 - 16:00
ORAL PRESENTATION</td><td>16:00 - 16:20
COFFEE</td><td>16:20 - 18:00
ORAL PRESENTATION</td><td>18:00 - 19:00
POSTER PRESENTATION</td><td>20:00 - 23:00
BOAT TRIP</td></tr>
<tr><td colspan="5">10:00 - 12:00
WORKSHOP 2</td><td colspan="6">14:00 - 17:30
WORKSHOP 3</td></tr>
<tr><td rowspan="2">WEDNESDAY JULY, 9</td><td>9:00 - 10:00
PL 7</td><td>10:00 - 11:00
ORAL PRESENTATION</td><td>11:00 - 11:20
COFFEE</td><td>11:20 - 12:40
ORAL PRESENTATION</td><td>12:40 - 13:40
LUNCH</td><td>13:40 - 14:40
PL 8</td><td>14:40 - 16:00
ORAL PRESENTATION</td><td>16:00 - 16:20
COFFEE</td><td>16:20 - 17:40
ORAL PRESENTATION</td><td colspan="2">17:40 - 18:40
POSTER PRESENTATION</td></tr>
<tr><td colspan="5">10:00 - 12:00
WORKSHOP 4</td><td colspan="6"></td></tr>
</table>

PLEANARY LECTURES

PL 1: The Periodic Table: Its Story and Its Significance
Eric Scerri

PL 2 : Improving Chemical Education:Turning Research Into Effective Practise
Peter Childs

PL 3: Sustainable Chemistries: Environmentally Friendly and Economically Viable!
Catherine T. Hunt

PL 4: The Laboratory In Chemical Education And Its Role In the Linking Of The Macro With The Submicro Levels Of Chemistry
Georgios Tsaparlis

PL 5 : Sustainable Chemistry and Chemistry Education
Ilka Parchmann & Arnim Luehken

PL 6: Engaging The Students With Outside- The-Box Pedagogy
Morton Hoffman

PL 7: The Wisdom of Practise: When Learning is Greater Than Teaching
Liberato Cardellini

PL 8: The Disabled Students and Their Teachers-How To Overcome The Difficulties In Teaching And Learning of Science
Iwona Maciejowska

WORKSHOPS

1. Research Ethics in Chemical Education
Leman Tarhan

2. Publishing In The Journal “Chemistry Education Research Practice (CERP)”
Georgios Tsaparlis and Stephen Breuer

3. From Teaching To “Know” –To Learning to “Think” A Tendem Action Research And Education For Sustainability.
Uri Zoller

4 Context- Based Chemistry Teaching,
Inci Morgil

The oral presentations will be of 20 minutes including discussion.
The conference is organized in 2 parallel sessions.
A 90 cm width and 100 cm height board will be alloted for each poster display
Presenters may display their material on several smaller sheets.
There will be three poster sessions organized in the afternoon of Monday 7th, Tuesday 8th and Wednesday 9th.

KOCATEPE HALL

MONDAY JULY, 7

09:00 - 10:00	PL 2	IMPROVING CHEMICAL EDUCATION: TURNING RESEARCH INTO EFFECTIVE PARTICLE Peter Childs
10:00 - 11:00	PL 3	SUSTAINABLE CHEMISTRIES: ENVIRONMENTALLY FRIENDLY AND ECONOMICALLY VIABLE! Catherine T. Hunt
11:00 - 11:20	COFFEE	

T1 : European educational programmes and projects

Chairs : Eric Scerri and Ali O. Sezer

	Speaker		**Tıtle**
11:20 - 11:40	G.Tsaparlis	T1O01	THE EUROPEAN PROJECT *PARSEL* : POPULARITY AND RELEVANCE OF SCIENCE EDUCATION FOR SCIENTIFIC LITERACY
11:40 - 12:00	R. G. Wallace	T1O02	SHARING EXPERTISE, AN EXAMPLE OF TRANS-EUROPEAN CO-OPERATION IN FORENSIC SCIENCE - THE EDUFORMAK PROJECT
12:00 - 12:20	P. C. Yates	T1O03	TRAINING NEWLY APPOINTED UNIVERSITY CHEMISTRY TEACHING STAFF: A EUROPEAN SUMMER SCHOOL
12:20 - 12:40	S. Hayes	T1O04	TEACHING SCIENCE IN THE IRISH TRANSITION YEAR: A WASTED OPPORTUNITY
12:40 - 13:40	LUNCH		

13:40 - 14:40	PL 4	THE LABORATORY IN CHEMICAL EDUCATION AND ITS ROLE IN THE LINKING OF THE MACRO WITH THE SUBMICRO LEVELS OF CHEMISTRY Georgios Tsaparlis

T2 : Learning and teaching chemistry

Chairs : Ilka Parchmann and Paul C. Yates

	Speaker		**Tıtle**
14:40 - 15:00	Y. Saglam	T2O01	HOW DO CURRENT ACID-BASE DEFINITIONS AFFECT STUDENTS' UNDERSTANDING IN THE CONTEXT OF CHEMICAL EQUILIBRIUM?
15:00 - 15:20	J. Välisaari	T2O02	STUDENTS' MISCONCEPTIONS ABOUT EXOTHERMIC AND ENDOTHERMIC REACTIONS
15:20 - 15:40	M. Sheehan	T2O03	THE PERSISTENCE OF STUDENTS' DIFFICULTIES IN CHEMISTRY
15:40 - 16:00	S. Ay	T2O04	HIGH SCHOOL STUDENTS' LEVEL OF EXPLAINING EVERYDAY PHENOMENA BASED ON CHEMISTRY KNOWLEDGE
16:00 - 16:20	COFFEE		

T2 : Learning and teaching chemistry

Chairs : Liberato Cardellini and Peter Childs

	Speaker		**Tıtle**
16:20 - 16:40	B. Feyzioglu	T2O05	DETERMINING MISUNDERSTANDING OF PRIMER TEACHER CANDIDATE ABOUT SEPERATION OF MIXTURE
16:40 - 17:00	B. Demirdag	T2O06	STUDENTS' VIEWS CONCERNING PROBLEM BASED LEARNING
17:00 - 17:20	G. Avitabile	T2O07	INTRODUCING CHEMISTRY TO THE GENERAL PUBLIC: A WEB SITE
17:20 - 17:40	D. Mozeika	T2O08	THE LEVEL OF STUDENTS' COGNITIVE INTEREST IN THE CONTEXT OF NATURAL SCIENCES EDUCATION
17:40 - 18:00	J. Brittain	T2O09	THE CHALLENGES OF TEACHING LARGE CLASSES - INCLUDING THE PROVISION OF SELF DIRECTED FORMATIVE LEARNING
18:00 - 19:00	POSTER PRESENTATION		
20:00 - 22:00	CONFERENCE DINNER		

FEVZI CAKMAK HALL

MONDAY JULY, 7

T3 : History of chemistry

Chairs : Mortan Hofmann and Iwona Maciejowska

	Speaker		Tıtle
11:20 - 11:40	S. E. Santos	T3O01	HISTORY OF ASPIRIN
11:40 - 12:00	M. E. Maia	T3O02	PROJECT: THE ARAB CONTRIBUTION TO THE DEVELOPMENT OF CHEMISTRY IN EUROPE

T4 : The past and future of chemistry textbooks

Chairs : Mortan Hofmann and Iwona Maciejowska

	Speaker		Tıtle
12:00 - 12:20	V. Gkitzia	T4O01	DEVELOPMENT OF CRITERIA FOR EVALUATION OF CHEMICAL REPRESENTATIONS IN SCHOOL TEXTBOOKS
12:20 - 12:40	L. M. Trejo	T4O02	AN INNOVATIVE CHEMISTRY TEXTBOOK FOR HIGH SCHOOL
12:40 - 13:40	LUNCH		

T5 : Chemistry teacher education

Chairs : Tina Overton and Catherine T. Hunt

	Speaker		Tıtle
14:40 - 15:00	A. Arroio	T5O01	VIDEO ANALYSIS INTO THE TRAINNING OF PRESERVICE CHEMISTRY TEACHER
15:00 - 15:20	S. Aydin	T5O02	ARE SENIOR PRE-SERVICE CHEMISTRY TEACHERS AWARE OF THE STUDENTS' MISCONCEPTIONS RELATED WITH PARTICULATE NATURE OF MATTER (PNM) IN THE CONTEXT OF GASES?
15:20 - 15:40	N. Yildirim	T5O03	TEACHERS' IDEAS ABOUT FEASIBILITY OF CHEMISTRY EXPERIMENTS AND VIEWS THE VIRTUAL CHEMISTRY LABORATORY
15:40 - 16:00	N. Aydemir	T5O04	HOW DO PRE-SERVICE CHEMISTRY TEACHERS LINK CHEMISTRY TO DAILY LIFE?
16:00 - 16:20	COFFEE		

T5 : Chemistry teacher education

Chairs : Betul Demirdogen and Mustafa Sozbilir

	Speaker		Tıtle
16:20 - 16:40	S. Aydin	T5O05	WHAT ARE THE PRE-SERVICE CHEMISTRY TEACHERS' MISCONCEPTIONS ON ACID-BASE CONCEPTS?
16:40 - 17:00	S. Aydin	T5O06	PRE-SERVICE CHEMISTRY TEACHERS' SUB-MICROSCOPIC KNOWLEDGE ABOUT SOLUTIONS
17:00 - 17:20	A. Tarkin	T5O07	PRE-SERVICE CHEMISTRY TEACHERS' SENSE OF EFFICACY AND THEIR ATTITUDES TOWARDS TEACHING AS A PROFESSION

17:20 - 17:40	S. Kingir	T5O08	PRESERVICE CHEMISTRY TEACHERS' VIEWS ABOUT SCIENTISTS
18:00 - 19:00	POSTER PRESENTATION		
20:00 - 22:00	CONFERENCE DINNER		

KOCATEPE HALL

TUESDAY JULY, 8

09:00 - 10:00 PL 5 SUSTAINABLE CHEMISTRY – A TOPIC FOR CHEMICAL
Ilka Parchmann

T2 : Learning and teaching chemistry

Chairs : Gultekin Cakmakci and Robert A. Pribush

	Speaker		Tıtle
10:00 - 10:20	T. Overton	T2O10	PHENOMENOGRAPHIC STUDY OF PROBLEM SOLVING IN CHEMISTRY UNDERGRADUATES
10:20 - 10:40	F. Turk	T2O11	DIFFERENT TEACHING METHOD FOR ELECTRONIC CONFIGURATION: AN ANALOGY ACTIVITY
10:40 - 11:00	O. E. Finlayson	T2O12	A MULTIDISCIPLINARY APPROACH - DOES IT ENCOURAGE ENGAGEMENT WITH ALL THE SCIENCES
11:00 - 11:20	COFFEE		

T2 : Learning and teaching chemistry

Chairs : Jan Lundell and Reiner Salzer

	Speaker		Tıtle
11:20 - 11:40	Y. Godek Altuk	T2O13	SCIENCE STUDENT TEACHERS' VIEWS CONCERNING CHILDREN'S LEARNING DIFFICULTIES, AND THE TECHNIQUES OF IDENTIFYING MISCONCEPTIONS
11:40 - 12:00	P. Ambrogi	T2O14	A NEW APPROACH TO IMPROVING SCIENCE LITERACY
12:00 - 12:20	J. P. Suits	T2O15	MOLECULAR ANIMATIONS AND STUDENTS' MENTAL MODELS OF CHEMICAL PHENOMENA AND PARTICULATE REPRESENTATIONS
12:20 - 12:40	R. A. Pribush	T2O16	FORMATIVE AND SUMMATIVE ASSESSMENT OF STUDENT UNDERSTANDING IN THE GENERAL CHEMISTRY CLASSROOM
12:40 - 13:40	LUNCH		

13:40 - 14:40 PL 6 ENGAGING THE STUDENTS WITH OUTSIDE-THE-BOX PEDAGOG
Morton Hoffman

T2 : Learning and teaching chemistry

Chairs : Paola Ambrogi and Fadwa Odeh

	Speaker		Tıtle
14:40 - 15:00	R. Salzer	T2O17	HOW TO TEACH QUANTITATIVE ANALYSIS ?
15:00 - 15:20	R. Hoban	T2O18	CAN CHANGING THE PEDAGOGICAL APPROACH RELATED TO THE MOLE CONCEPT IMPROVE STUDENTS' PROCEDURAL AND CONCEPTUAL UNDERSTANDING OF THE MOLE?
15:20 - 15:40	R. Wietecha-Posłuszny	T2O19	HOW TO REDOUBLE PUPILS' MOTIVATION? - CRIME SCENE INVESTIGATION EXERCISE

16:00 - 16:20	COFFEE		

T2 : Learning and teaching chemistry

Chairs : Paola Ambrogi and Fadwa Odeh

	Speaker		**Tıtle**
16:20 - 16:40	C. Cigdemoglu	T2O20	A COMPARATIVE STUDY OF NONSCIENCE MAJORS' & SCIENCE MAJORS' MOTIVATION TO LEARN CHEMISTRY, THEIR VIEWS ON CHEMISTRY AND SOCIETY
16:40 - 17:00	M. Mohammad	T2O21	FROM AVERAGE VALUE AND STANDARD DEVIATION TO FLUCTUATION , DIFFUSION, RANDOM WALK / BROWNIAN MOVEMENT, UNCERTAINTY PRINCIPLES, ENERGY OF HELIUM ATOM AND BIG BANG THEORY

T6 : Green chemistry and environmental chemistry education

Chairs : Jan Lundell and Lale Aka Burk

	Speaker		**Tıtle**
17:00 - 17:20	M. Sozbilir	T6O01	TEACHING ENVIRONMENTAL PROBLEMS CAUSED BY STUBBLE FIRES, OZON LAYER DEPLETION AND VEHICLES THROUGH PROBLEM-BASED LEARNING
17:20 - 17:40	Z. Ozcelik	T6O02	IMPORTANCE OF VOC LEVEL IN THE ATMOSPHERE: EMISSION SOURCES AND DESTRUCTION TECHNIQUES OF VOCs
17:40 - 18:00	V. D. Krsmanovic	T6O03	ICT PROJECT ON CLEANING OIL SPILLS
18:00 - 19:00	POSTER PRESENTATION		
20:00 - 23:00	BOAT TRIP		

FEVZI CAKMAK HALL

TUESDAY JULY, 8

T5 : Chemistry teacher education

Chairs : Jerry P. Suits and V. D. Krsmanovic

	Speaker		Tıtle
10:00 - 10:20	M. Ozden	T5O09	SCIENCE STUDENT TEACHERS' IDEAS OF ATOMS AND MOLECULES: USING DRAWINGS AS A RESEARCH METHOD
10:20 - 10:40	O. Tastan	T5O10	PRE-SERVICE CHEMISTRY TEACHERS' CONCEPTIONS ABOUT REACTION RATE
10:40 - 11:00	Jan Lundell	T5O11	INTEGRATING COMPUTATIONAL CHEMISTRY INTO CHEMISTRY TEACHER EDUCATION
11:00 - 11:20	COFFEE		

T5 : Chemistry teacher education

Chairs : Jerry P. Suits and V. D. Krsmanovic

	Speaker		Tıtle
11:20 - 11:40	B. Demirdogen	T5O12	PRE-SERVICE CHEMISTRY TEACHERS' PEDAGOGICAL CONTENT KNOWLEDGE ABOUT THE PARTICLE NATURE OF MATTER

T7 : Chemistry and industry

Chairs : Małgorzata Bartoszewicz and Francisca Viegas

	Speaker		Tıtle
11:40 - 12:00	Z. Rezvani	T7O01	SYNTHESIS AND INVESTIGATION OF OPTICAL AND THERMAL PROPERTIES OF NI(II) AND CU(II) COMPLEXES WITH AZO-CONTAINING SCHIFF-BASE LIGANDS
12:00 - 12:20	S. H. Jordanov	T7O02	CHEMISTRY – A VITAL PILLAR TO HOLD THE BUILDING NAMED 'SUPPLIES FOR TOMORROW'
12:20 - 12:40	A. Nezhadali	T7O03	OPTIMIZATION CONDITIONS IN THE ANALYSIS OF IMPORTANT COMPOUNDS OF ELAEAGNUSAN GASTIFALIAL USING HS-SPME/GC/MS
12:40 - 13:40	LUNCH		

T8 : Teaching chemistry in secondary schools and universities

Chairs : David Salter and Burak Feyzioglu

	Speaker		Tıtle
14:40 - 15:00	A. O. Sezer	T8O01	TEACHING COLLEGE CHEMISTRY TO THE "YOUTUBE" GENERATION
15:00 - 15:20	S. Taghizadeh	T8O02	STUDY OF ANALOGY APPLICATION ON EFFECTIVE TEACHING CHEMISTRY AT HIGH SCHOOL
15:20 - 15:40	B. Acar	T8O03	AN ACTIVE LEARNING APPLICATION ON "ACIDS AND BASES": LEARNING ACHIEVEMENT AND ATTITUDES TOWARDS ACTIVE LEARNING

15:40 - 16:00	B. Acar	T8O04	EXAMINING STUDENTS ACHIEVEMENTS AND BELIEFS DURING PROBLEM-BASED LEARNING APPLICATION IN "NEUTRALIZATION AND TITRATION"
16:00 - 16:20	COFFEE		

T8 : Teaching chemistry in secondary schools and universities

Chairs : Ali O. Sezer and Michal Drechsle

	Speaker		**Tıtle**
16:20 - 16:40	F. Viegas	T8O05	TEACHING THE CONCEPT OF ELECTRON IN SECONDARY SCHOOL CHEMISTRY
16:40 - 17:00	D. Salter	T8O06	FIRST-YEAR UNIVERSITY CHEMISTRY EDUCATION: A NEW ZEALAND CONTEXT
17:00 - 17:20	B. Feyzioglu	T8O07	AN INVESTIGATION OF STUDENTS' VIEWS ABOUT THE EFFECTS OF COMPUTER BASED PUZZLES IN THEIR SCIENCE AND TECHNOLOGY LESSON
17:20 - 17:40	B. Feyzioglu	T8O08	STUDENTS' OPINION ABOUT COMPUTER BASED PUZZLES EFFECTS IN SCIENCE EDUCATION
17:40 - 18:00	F. Odeh	T8O09	THE USE OF ADVANCED TECHNİQUES AND EXPERIMENTS IN UNDERGRADUTE PHYSICAL CHEMISTRY LABORATORIES
18:00 - 19:00	POSTER PRESENTATION		
20:00 - 23:00	BOAT TRIP		

KOCATEPE HALL

WEDNESDAY JULY, 9

09:00 - 10:00	PL 7	THE WISDOM OF PRACTICE: WHEN LEARNING IS GREATER THAN TEACHING Liberato Cardellini

T8 : Teaching chemistry in secondary schools and universities

Chairs : Odilla Finlayson and Uri Zoller

	Speaker		**Tıtle**
10:00 - 10:20	A. Cam	T8O10	ANALYSIS OF HIGH SCHOOL SCIENCE STUDENTS' EPISTEMOLOGICAL BELIEFS ON THEIR CHEMISTRY ACHIEVEMENT
10:20 - 10:40	C. Kadioglu	T8O11	DIFFERENCES IN 10TH GRADE STUDENTS MOTIVATIONAL ORIENTATIONS IN CHEMISTRY BY SCHOOL TYPE
10:40 - 11:00	C. Kadioglu	T8O12	10^{th} GRADE STUDENTS' MOTIVATIONAL BELIEFS IN HIGH SCHOOL
11:00 - 11:20	COFFEE		

T8 : Teaching chemistry in secondary schools and universities

Chairs : Jan Apotheker and
Georgios Tsaparlis

	Speaker		**Tıtle**
11:20 - 11:40	M. Drechsler	T8O13	TEACHING ACIDS AND BASES IN SWEDISH UPPER SECONDARY SCHOOLS
11:40 - 12:00	E. Budak	T8O14	DEVELOPING TEACHING SEQUENCES FOR PH MEASUREMENTS BY GLASS ELECTRODE CELLS: IMPROVING UNDERGRADUATE STUDENTS' UNDERSTANDINGS OF NATURE OF SCIENCE THROUGH EXPLICIT ARGUMENTATION
12:00 - 12:00	E. B. McCrudden	T8015	CHANGES IN THE LEAVING CERTIFICATE HIGHER LEVEL CHEMISTRY SYLLABUS, HAVE THEY BEEN REFLECTED IN THE ASSESSMENT?
12:20 - 12:40	L. McCormack	T8O16	THE DEVELOPMENT AND EVALUATION OF SECOND LEVEL CHEMISTRY LESSONS, CENTRAL TO THE COGNITIVE ACCELERATION THROUGH SCIENCE EDUCATION METHODOLOGY

12:40 - 13:40	LUNCH	
13:40 - 14:40	PL 8	THE DISABLED STUDENTS AND THEIR TEACHERS - HOW TO OVERCOME THE DIFFICULTIES IN TEACHING AND LEARNING OF SCIENCE Iwona Maciejowska

T8 : Teaching chemistry in secondary schools and universities

Chairs : Jan Apotheker and Georgios Tsaparlis

	Speaker		Tıtle
14:40 - 15:00	J. Lovatt	T8O17	SELGGOG ABBEY – A CONTEXT LABORATORY PROBLEM FOR INTRODUCTORY UNDERGRADUATE CHEMISTRY

T9 : Chemical education research

Chairs : Stuart W. Bennett and Marek Kwiatkowski

	Speaker		Tıtle
15:00 - 15:20	B. Byers	T9O01	OPENING THE PORTAL TO SELF-REGULATED LEARNING: USING LEARNING LOGS TO DEVELOP METACOGNITIVE SKILLS
15:20 - 15:40	N. Rideg	T9O02	"PICTURES OF AN EXHIBITION"- A POSSIBLE WAY TO MAKE CHEMISTRY MORE POPULAR
15:40 - 16:00	J. Apotheker	T9O03	FRUITS OF WISDOM, AN EXPERIMENT IN COOPERATIVE LEARNING IN REGGIO EMELIA
16:00 - 16:20	COFFEE		

T9 : Chemical education research

Chairs : Bill Byers and Nora Rideg

	Speaker		Tıtle
16:20 - 16:40	S. W. Bennett	T9O04	ASSESSMENT OF PRACTICAL WORK: A CROSS-EUROPE SNAPSHOT
16:40 - 17:00	X. Vamvakeros	T9O05	EPISTEMIC VIEWS OF PHD GRADUATE SCIENTISTS AND THEIR IMPACT ON CHEMICAL EDUCATION
17:00 - 17:20	N. Yildirim	T9O06	DEVELOPING TWO-TIER TEST RELATED TO CHEMICAL EQUILIBRIUM

T10 : Chemistry studies in the context of Bologna process

Chairs : X. Vamvakeros

	Speaker		Tıtle
17:20 - 17:40	M. Kwiatkowski	T10O1	AFTER THE BOLOGNA REFORM: STUDENT MULTIMEDIA PRESENTATIONS AS BACHELOR OF CHEMISTRY DIPLOMA PROJECTS IN TEACHER TRAINING AT THE UNIVERSITY OF GDANSK

17:40 - 18:40 POSTER PRESENTATION

THE PERIODIC TABLE: ITS STORY AND ITS SIGNIFICANCE

Eric Scerri
Department of Chemistry & Biochemistry, University of California at Los Angeles (UCLA).

The periodic table is absolutely central to chemistry and chemical education and yet little attention has been devoted to its origins and its theoretical status with respect to quantum mechanics, which is generally supposed to explain it fully.
The lecture will draw on the author's recent book, *The Periodic Table, Its Story and Its Significance, (Oxford University Press)*, in an attempt to redress this imbalance. This will include a historical survey of the periodic table of the elements including the work of precursors, and six independent discoverers, to the impact of modern physics including the discovery of the electron, radioactivity and isotopes as well as theoretical approaches due to Bohr, Pauli and Schrödinger. The lecture will conclude with some thoughts on whether there might be an 'optimal form' of the periodic table and what this might look like.

POSTER PRESENTATION

MONDAY JULY, 7
18:00 - 19:00

T2 : Learning and Teaching Chemistry

T2P01	Maryam Dorri	DYNAMIC PATTERNS IN TEACHING CHEMISTRY
T2P02	Claudio Giomini	UNCHARGED TRIVALENT CARBON IN NON-RADICALIC MOLECULAR STRUCTURES ACCORDING TO THE VALENCE BOND THEORY
T2P03	Vlassi Maria	STUDENTS' DIFFICULTY IN CONNECTING THE PROPERTIES OF THE COMPOUNDS WITH CHEMICAL BONDING; MISCONCEPTIONS OF GREEK STUDENTS
T2P04	Ali Reza Modarresi-Alam	THE AIM, IMPORTANCE AND METHODS OF ASYMMETRIC SYNTHESIS
T2P05	Zoltán Tóth	RELATIONSHIP BETWEEN STUDENTS' KNOWLEDGE STRUCTURE AND PROBLEM SOLVING STRATEGY IN STOICHIOMETRY
T2P06	Akbar Naseriazar	EXPLORING STUDENT'S CONCEPTIONS ABOUT LIMITING REAGENTS AND THEIR ABILITIES TO REALIZING &DETERMINING LIMITING REAGENT
T2P07	Sevil Kurt	REFLECTING STUDENTS' UNDERSTANDING LEVELS ON CHEMICAL KINETICS CONCEPTS
T2P08	Soleyman Rohizad	INTRODUCING AN INNOVATIVE NEW WAY FOR LEWIS MOLECULAR STRUCTURE EDUCATION BASED ON ICT
T2P09	Baris Demirdag	IDENTIFICATION OF ALTERNATIVE CONCEPTION OF UNIVERSITY STUDENTS ON MATTER PHASE
T2P10	Nail İlhan	A COMPARISON OF CONTEXT-BASED AND PROBLEM-BASED LEARNING
T2P11	C. Giomini	A PITFALL IN INDIRECT ANALYSIS CALCULATIONS
T2P12	Burak Feyzioglu	A COMPARATIVE APPLICATION OF DIFFERENT LEARNING PROCESS FOR REMOVING OF MISCONCEPTIONS ABOUT CHEMICAL BONDING
T2P13	Suat Turkoguz	WORKSHEETS TOWARD VISUAL ARTS ACTIVITIES ADAPTED BY OBJECTS ABOUT PARTICULATE NATURE OF MATTER IN CHEMISTRY TOPICS OF SCIENCE AND TECHNOLOGY COURSE
T2P14	A. Nowroozi	NBO SOFTWARE; A POWERFUL TOOL IN CHEMICAL EDUCATION
T2P15	Katerina Salta	FACTORS THAT INFLUENCE STUDENTS' PERFORMANCE ON SCIENCE IN A CROSS - CULTURAL CONTEXT
T2P16	M. Nikonezhad	A WORKSHOP ON SCIENCE EDUCATION
T2P17	Ozge Ozbayrak	DEVELOPMENT AND APPLICATION TWO-TIER DIAGNOSTIC TEST ABOUT CHEMICAL BONDING FOR UNIVERSITY STUDENTS
T2P18	Melis Arzu Cekci	DEVELOPMENT AND APPLICATION OF A DIAGNOSTIC

T2P19	Javad Hatami	AN INVESTIGATION INTO THE EFFECTIVENESS OF CONCEPT MAP-BASED LEARNING IN A CHEMISTRY COURSE
T2P20	Ozge Ozgen	THE RESPONSIBILITIES OF TEACHERS IN LABORATORY SAFETY PROGRAMS
T2P21	Ozge Ozgen	PROMOTING THE CHEMISTRY EDUCATION WITH VISUAL PRESENTATION EQUIPMENT IN EDUCATIONAL INSTITUTIONS
T2P22	Filiz AVCI	THE DIFFICULTIES OF ALGORITHM PROBLEM SOLUTIONS IN THE CHEMISTRY LESSONS
T2P23	Liberato Cardellini	SCORING GENERAL CHEMISTRY CONCEPT MAPS: SOME PRELIMINARY RESULTS
T2P24	Cetin Dogar	THE EFFECTS OF USING LOW COST MATERIAL FOR MOLECULAR MODELING
T2P25	Katarina Sedlar	EXPERIMENTS WITH THE CANDLE - ALTERNATIVE CONCEPTS AND CHEMISTRY TEACHING
T2P26	Panagiotis Stilianidis	FACTORS THAT INFLUENCE STUDENTS’ PERFORMANCE ON SCIENCE IN A CROSS-CULTURAL CONTEXT
T2P27	Panagiotis Palamitzoglu	‘HYDROXYL GROUP’ (-OH) AND ‘HYDROXIDE ION’ (OH-): TWO CHEMICAL SPECIES AND TERMS WITH PROBLEMATIC USAGE BY TEACHERS AND STUDENTS
T2P28	Małgorzata Szafarska	JUSTICE ABOVE ALL ELSE – ANALYTICAL CHEMISTRY IN A FORENSIC COSTUME
T2P29	Paweł Kościelniak	A FORENSIC LABORATORY CLASS - APPLICATION OF THE AFS METHOD TO POST-MORTEM EXAMINATION OF ACUTE TOXIC METAL POISONING
T2P30	F.Ahmadi	USING SIMPLE EXPERIMENTS FOR TEACHING SCIENCE – CASE STUDY ELECTROSTATIC
T2P31	F.Ahmadi	INTERACTIVE TEACHING MODELS EFFECTS ON LEARNING KINEMATIC CONCEPTS
T2P32	F.Ahmadi	CHANGING A LABORATORY COURSE TO A MODERN INQUIRY WORKSHOP
T2P33	M. Bartoszewicz	INNOVATIVE TEACHING OF CHEMISTRY

T3 : History of Chemistry

T3P01	Maria Elisa Maia	INTEGRATING HISTORY OF CHEMISTRY IN SCHOOL CURRICULA
T3P02	Maria Elisa Maia	STUDENTS’ IDEAS ABOUT ALCHEMY
T3P03	Jalaldin Zangeneh	THE ROLE OF THE HISTORY OF SCIENCE IN CHEMISTRY EDUCATION
T3P04	Aydın Tavman	A PORTRAIT FROM CHEMISTRY HISTORY: THE RISE AND FALL OF FRITZ HABER
T3P05	Elif Caliskan	THE ORIGIN OF PHYSICAL CHEMISTRY EDUCATION IN TURKEY
T3P06	Aylin Günay Sarı	A CASE STUDY ON HISTORY OF SCIENCE: “NOT WITHOUT RESEARCH”

T3P07	Musa Sahin	IMPORTANT SCIENTISTS AND DEVELOPMENTS FORMING BASES OF MODERN CHEMISTRY
T3P08	Mirjam D. Steffensky	EARLY SCIENCE EDUCATION − MORE THAN BAKING SODA AND VINEGAR?
T3P09	Pasqualina Mongillo	“MARIA BAKUNIN, 'THE LADY' OF CHEMISTRY"

T4 : The Past and Future of Chemistry Textbooks

T4P1	Chrisina D. Stefani	QANTUM THEORY IN SECONDARY CHEMISTRY TEXTBOOK IN GREECE
T4P2	Funda Savasci Acikalin	AN ANALYSIS OF REPRESENTATIONS OF THE PARTICULATE NATURE OF MATTER IN TURKISH CHEMISTRY TEXTBOOKS

POSTER PRESENTATION

TUESDAY JULY, 8
18:00 - 19:00

T5 : Chemistry Teacher Education

T5P01	Dragica Trivić	SCHOOL PRACTICE – AN IMPORTANT PART OF THE CHEMISTRY TEACHERS EDUCATION
T5P02	Lizette Ramos De Robles	AN APPROACH TO CHEMICAL CHANGE AND LIVING BEING MODELS TROUGH EXPERIMENTAL NARRATIVES: THE CASE OF PRESERVICE PRIMARY TEACHERS' EDUCATION
T5P03	Incı Morgil	THE AFFECTIVE AND COGNITIVE FACTORS WHICH EFFECT TECHNOLOGY USAGE OF PRE-SERVICE CHEMISTRY TEACHERS
T5P04	Deniz Sarıbas	THE INFLUENCE OF METACOGNITIVE AWARENESS DEVELOPMENT ON PRE-SERVICE SCIENCE TEACHERS' SCIENTIFIC KNOWLEDGE AND UNDERSTANDING SCIENCE
T5P05	Ercan Ari	THE IMPACT OF LEARNING STYLES ON THE ACHIEVEMENT, SCIENTIFIC PROCESS SKILLS AND ATTITUTES OF PRESERVISE SCIENCE TEACHERS THROUGH GENERAL CHEMISTRY LABORATORY
T5P06	Cristian Merino Rubilar	USING SCHEMATIC REPRESENTATIONS AND EXPERIMENTAL NARRATIVES IN CHEMISTRY TEACHER EDUCATION
T5P07	Nail Ilhan	STUDENTS' INTEREST IN THE USAGE OF ORGANIC CHEMISTRY IN DAILY LIFE
T5P08	Anne Laajaniemi	FINNISH CHEMISTRY TEACHERS' IDEAS OF MEANINGFUL CHEMICAL TECHNOLOGY EDUCATION
T5P09	F. Gulay Kirbaslar	PRE-SERVICE SCIENCE TEACHER ALGORITHMIC AND CONCEPTUAL PROBLEM SOLVING ATTITUDES AND BEHAVIOURS IN THE CHEMISTRY LESSONS
T5P10	Adem Cinarli	PRE-SERVICE SCIENCE TEACHER VIEWS ABOUT USE OF TECHNOLOGY IN THE GENERAL CHEMISTRY LABORATORY
T5P11	Zeliha Ozsoy Gunes	CONTRIBUTION OF CHEMISTRY LABORATORY WORKS TO LESSON FOR PRE-SERVICE SCIENCE AND MATHEMATICS TEACHER
T5P12	Funda Savasci Acikalin	TURKISH PRE-SERVICE TEACHER CONCEPTIONS OF THE PARTICULATE NATURE OF MATTER
T5P13	Funda Savasci Acikalin	TURKISH PRE-SERVICE TEACHER BELIEFS ABOUT TEACHING AND LEARNING OF SCIENCE
T5P14	Ceyhan Cigdemoglu	PRESERVCE CHEMISTRY TEACHERS' CONCEPTUALIZATIONS OF THE NATURE OF SCIENCE, SOCIOSCIENTIFIC ISSUE; GLOBAL WARMING
T5P15	Helena Klímová	CHEMISTRY TEACHER EDUCATION IN THE CZECH REPUBLIC
T5P16	M. Bartoszewicz	TYPES AND FUNCTIONS OF SIMULATIONS IN THE CIEKAWA CHEMIA (ABSORBING CHEMISTRY)

T7 : Chemistry and Industry

T7P01	Hedhihi Lassaad	TOWARDS GAS CHROMATOGRAPHY–MASS SPECTROMETRY COUPLING PROTOCOLS FOR BOTH IDENTIFYING AND QUANTIFICATION ESSENTIAL OILS OF AROMATIC AND MEDICINAL PLANT OF THE TUNISIAN FLORA
T7P02	Zine Kechrid	THE BENEFIT EFFECT OF VITAMIN E ON TOXICITY OF NICKEL IN LEPUS CUNICULUS RABBITS
T7P03	E. E. Saad	UTILIZATION OF RUTA GRAVELENS LEAVES AS A BIO-ADSORBENT MATERIAL OF PB(II) FROM AQUEOUS SOLUTION
T7P04	Kamila Najati	STUDY OF SOLID POLYMORPHISM IN COPPER(II) COMPLEXES DERIVED FROM AZO CONTAINING BIDENTATE LIGANDS BY POWDER X-RAY DIFFRACTION
T7P05	B .Massoumi	DEPOSITION, GROWTH PROCESSES AND CHARACTERIZATION OF POLY (DIPHENYLAMINE- CO – ANILINE)
T7P06	Iran Sheikhshoaie	EVALUATION ON THE STRUCTURAL AS SELECTIVE ELECTRODES FOR REMOVING TRACE METAL IONS BY SOME ORGANIC COMPOUNDS BY USING SOME QUANTUM MECHANIC CALCULATIONS
T7P07	Iran Sheikhshoaie	A THEORETICAL INVESTIGATION ON THE INHIBITION PROPERTY BY SOME ORGANIC COMPOUNDS AS ANTI CORROSION MATERIALS FOR MILD STEEL
T7P08	Ali Mostafavi	EXTRACTION OF VOLATILE COMPOUNDS OF CATKIN (SALIX AEGYPTIACA L.) BY SIMULTANEOUS HYDRODISTILATION AND EXTRACTION
T7P09	Tayebeh Shamspur	COMPARISON OF ESSENTIAL OILS OF MATRICARIA RECUTITA EXTRACTED WITH SOXHLET EXTRACTION AND OTHER TRADITIONAL EXTRACTION METHODS
T7P10	Massoumeh Bagheri	LIQUID-CRYSTALLINE POLYESTER DENDRIMER
T7P11	Abbas Shahidy	FLAME ATOMIC ABSORPTION SPECTROMETRY AND DETERMINATION TRACE AMOUNT OF CU+2 AFTER PRECONCENTRATION BY MODIFIED ANALCIME ZEOLITE COATED WITH N, N´- BIS (4- PHENYLAZO SALICYLALDIMINE) 3- CHLORO -1, 2 PHENYLENDIAMINE
T7P12	Abbas Shahidy	DETERMINATION OF TRACE AMOUNTS OF NI IONS IN AQUEOUS SAMPLES
T7P13	H. Razmi	PREPARATION, ELECTROCHEMISTRY AND ELECTROCATALYTIC ACTIVITY OF LEAD PENTACYANONITROSYLFERRATE FILM IMMOBILIZED ON CARBON CERAMIC ELECTRODE
T7P14	D.E.Akretche	IMPACT OF CHEMISTRY EDUCATION IN A MASTER OF WATER SCIENCES
T7P15	M. Chater	THE INTERFACE CHEMISTRY/INDUSTRIAL CHEMISTRY ON THE MASTERS OF SCIENCES IN A FACULTY OF CHEMISTRY
T7P16	B. Massoumi	EFFECT OF ORGANIC ACID DOPANTS ON THE CONDUCTIVITY, SOLUBILITY OF POLYANILINE, POLY(1-NAPHTYLAMINE) AND

T7P17	Adeleh Moshtaghi Zonouz	TRICARBONYLCHROMIUM COMPLEXES OF 2-SUBSTITUTED-1,4-DIHYDROPYRIDINE DERIVATIVES: REGIO- AND STEREOSELECTIVE REACTIONS
T7P18	Abebe Belay	MEASUREMENT INTEGRATED ABSORPTION CROSS SECTION, OSCILLATOR STRENGTH AND NUMBER DENSITY OF CAFFEINE IN COFFEE BEANS BY INTEGRATED ABSORPTION COEFFICIENT TECHNIQUE
T7P19	M. Dehestani	EFFECT OF VIBRONIC INTERACTIONS IN ABSORPTION AND RESONANCE RAMAN SPECTRA OF TRANS- 1, 3, 5-HEXATRIENE MOLECULE
T7P20	Z. Garkani-Nejad	QSAR STUDY OF 2-PHENYLNAPHTHALENE SCAFFOLD INHIBITORS ON ESTROGEN RECEPTOR (ERα): A GA-MLR-ANN APPROACH
T7P21	Asli Gok	(LIQUID – LIQUID) EQUILIBRIA OF (WATER + LEVULINIC ACID + ESTERS) TERNARY SYSTE
T7P22	Azizollah Nezhadili	SIMULATION OF PRECIPITATION TITRATION OF IODIDE ION WITH SILVER NITRATE SOLUTION USING PH GLASS ELECTRODE
T7P23	Mina Akbarpour	STUDY OF CHEMICAL COMPOSITION OF ARTEMISIA HERBA (A PLANT TRADITIONALLY USED IN IRAN AS AN HERBAL MEDICINE) USING HYDRO DISTILLATION FOLLOWED BY GAS CHROMATOGRAPHY MASS SPECTROMETRY
T7P24	Fatih Yilmaz	OCCUPATIONAL HEALTH AND SAFETY IN CHEMISTRY EDUCATION AND APPLICATION TO ASBESTOS
T7P25	Cigdem Cingil Baris	WHAT WE KNOW ABOUT GENETICALLY MODIFIED (GM) FOODS
T7P26	Sanat Kumar Mishra	VANADIUM (V) COMPLEXES OF FUNCTIONALIZED CARBONIC ACIDS
T7P27	B. Habibi	ELECTROCATALYTIC OXIDATION OF METHANOL ON PLATINUM NANO-PARTICLES ELECTRODEPOSITED INTO POLYANILINE/PALLADIUM/ALUMINUM ELECTRODE
T7P28	Hatice Tugsavul	CHEMISTRY TECHNOLOGY AND COOPERATION OF YOUTH ACHIEVEMENT EDUCATION FOUNDATION
T7P29	H. Cihangir Tugsavul	OCCUPATIONAL SAFETY AND ARSENIC IN VOCATIONAL EDUCATION
T7P30	Shila Najafian	DEPOSITION, GROWTH PROCESSES AND CHARACTERIZATION OF POLY (DPHENYLAMINE- CO – ANILINE)

POSTER PRESENTATION

WEDNESDAY JULY, 9

17:40 - 18:40

T6 : Green Chemistry and Environmental Chemistry Education

T6P01	Jorge Hernández	ENVIROMENTAL ANALYTICAL CHEMISTRY WITH EDUCATIONAL PURPOSES: MEASUREMENT OF DISSOLVED OXYGEN AND CONDUCTIVITY IN WASTEWATERS
T6P02	Sevil Kurt	HOW DO CHEMISTRY STUDENT TEACHERS EXPLAIN REAL WORLD AROUND OF THEM?
T6P03	E. Tojo	SYNTHESIS OF COUMARINS IN AN IONIC LIQUID: AN ADVANCE UNDERGRADUATE PROJECT OF GREEN CHEMISTRY
T6P04	Jalaldin Zangeneh	THE IMPORTANCE OF GREEN CHEMISTRY EDUCATION
T6P05	Rasool Jasmshidi	ORGANO NAOCLAY AS A GREEN SORBENT FOR REMOVAL OF HAZARDOUS MATERIALS FROM WASTE WATER

T8: Teaching Chemistry in Secondary Schools and Universities

T8P01	Jean-Pierre Rabine	LEARNING SPECTROSCOPY WITH COMPUTERS: THE NICE APPROACH
T8P02	Maria Estela Jardim	MOLECULAR SYMMETRY AND ART: ESCHER AND THE PALACE OF THE ALHAMBRA
T8P03	Farshid Rahimi	INTRODUCING A NEW ANALOGY FOR TEACHING OF PATH DEPENDENT AND STATE THERMODYNAMIC FUNCTIONS
T8P04	Vafa Ahmadi	STUDY OF 3DMAX AND MACROMEDİA FLASH USAGE EFFECT ON LEARNING OF ELECTROCHEMICAL CONCEPTS AT HIGH SCHOOL
T8P05	Abed Badrian	INVESTIGATION THE IMPACTS OF WEB-BASED CHEMISTRY COURSES ON CHEMICAL LITERACY AMONG HIGH-SCHOOL STUDENTS
T8P06	Bahareh Honarparvar	DESIGNING AND ACCREDITING AN ICT- BASED EFFECTIVE MODEL FOR TEACHING AND LEARNING OF CHEMISTRY IN SECONDARY SCHOOLS
T8P07	Hülya Kutu	A MODEL FOR COMPUTER SUPPORTED CONTEXT-BASED CHEMISTRY TEACHING BASED ON ARCS MOTIVATION MODEL
T8P08	Nagihan Yıldırım	USING WORKSHEETS BASED ON 4E TEACHING MODEL DURING TEACHING
T8P09	Ibrahim Bilgin	THE EFFECTS OF QUIDED INQUIRY INSTRUCTION UNIVERSITY STUDENTS' ACHIEVEMENT ON ACID AND BASES CONCEPTS
T8P10	Mustafa Ozden	IMPROVING SCIENCE AND TECHNOLOGY/ CHEMISTRY EDUCATION ACHIEVEMENT USING MASTERY LEARNING MODEL

T8P11	Hasan Yolcu	AN EXPERIMENT FOR DEMONSTRATION OF SOLID-GAS PHASE TRANSITION
T8P12	F. Abeer Al-Bawab	THE EFFECT OF USING COMPUTER, MULTIMEDIA SYSTEM & FREE INQUIRY ON SCIENCE FACULTIES STUDENTS' FOR PRACTICAL CHEMISTRY LEARNING ON ACQUIRING SCIENCE PROCESS SKILLS AT THE UNIVERSITY OF JORDAN
T8P13	Cansel Kadioglu	A QUALITATIVE STUDY ON 10TH GRADE STUDENTS' EPISTEMOLOGICAL VIEWS AND LEARNING BELIEFS IN SCIENCE COURSES
T8P14	Sevgi Kingir	WHAT ARE THE FACTORS PREDICTING 9TH GRADE STUDENTS' CHEMISTRY ACHIEVEMENT?
T8P15	Halil Tümay	DEVELOPING AND EXAMINING THE EFFECTS OF NATURE OF SCIENCE REFLECTION PROMPTS IN GENERAL CHEMISTRY LABORATORY
T8P16	Ali Khoider	THE IMPACT OF THE LMD SYSTEM ON THE TEACHING OF THE CHEMISTRY IN ALGERIA
T8P17	Berat Ilhan-Ceylan	AN OVERVIEW OF OXOTRANSFER REACTIONS IN BIOINORGANIC CHEMISTRY LECTURE
T8P18	Eren Ceylan	FACILITATING CONCEPTUAL CHANGE IN STATE OF MATTER AND SOLUBILITY CONCEPTS USING 5E INSTRUCTIONAL MODEL
T8P19	Yavuz Selim Aşçı	BIOLOGICAL AND BIOCHEMICAL SCIENCES IN CHEMICAL ENGINEERING EDUCATION IN TURKEY
T8P20	S. Nihal Yesiloglu	EXAMINING THE EFFECTS OF ARGUMENTATION-BASED TEACHING STRATEGIES ON SECONDARY TURKISH STUDENTS' UNDERSTANDINGS OF NATURE OF SCIENCE
T8P21	Nail Ilhan	A COMPARISON OF CONTEXT-BASED AND PROBLEM-BASED LEARNING

T9 : Chemical Education Research

T9P01	Mehmet Karakas	A CASE OF ONE PROFESSOR'S TEACHİNG AND USE OF NATURE OF SCIENCE IN AN INTRODUCTORY CHEMISTRY COURSE
T9P02	Hossein Tavakol	STUDY OF UNDERGRADUATE CHEMISTRY EDUCATION IN IRAN
T9P03	Rasol Abdullah Mirzaie	STUDY OF STUDENTS' MENTAL IMAGES EFFECT ON LEARNING CHEMISTRY
T9P04	Mirjana Marković	HOMEWORK ASSIGNMENTS IN CHEMISTRY LEARNING
T9P05	İnci Morgil	THE EFFECT OF MEDIA NEWS ON CHEMSTRY EDUCATION
T9P06	H. Roohi	CHARACTERIZATION OF HYDROGEN BONDING BY QUANTUM THEORY OF ATOMS IN MOLECULES (QTAIM)
T9P07	Agnaldo Arroio	COMMUNICATING SCIENCE: CHEMISTRY IN THE CINEMA
T9P08	Agnieszka Kamińska-Ostęp	CHEMISTRY TEACHERS KNOWLEDGE ABOUT EDUCATION OF

T9P09	Khawola A. Flayeh	CHEMISTRY IS A LIVE AND FASCINATING SUBJECT
T9P10	Maria Elisa Maia	USE OF WORD ASSOCIATION TESTS IN CHEMICAL EDUCATION RESEARCH IN THE CLASSROOM – SOME EXAMPLES
T9P11	Azra Rade	A DESCRIPTIVE WEBLIOGRAPHY OF CHEMISTRY LECTURE DEMONSTRATIONS
T9P12	Jalaldin Zangeneh	THE RELATION AND NATURE OF CHEMICAL KNOWLEDGE AND CHEMICAL EDUCATION
T9P13	Greta Tikkanen	THE TEST ITEMS OF THE FINNISH MATRICULATION EXAMINATION IN CHEMISTRY
T9P14	M. Dehestani	CONCEPT OF ATOMIC ORBITALS
T9P15	Javad Hatimi	AN INVESTIGATION INTO THE EFFECTIVENESS OF CONCEPT MAP-BASED LEARNING IN A CHEMISTRY COURSE
T9P16	Necla Donmez Usta	INVESTIGATION ON PREPARED RELATION WITH EVERDAY LIFE MATERIALS OF EFFECTIVENESS OF STUDENTS' UNDERSTANDING LEVEL ABOUT "MATTERS OF DENSITY PHASES"
T9P17	H. Cihangir Tugsavul	REACH AND CHEMISTRY EDUCATION
T9P18	H. Cihangir Tugsavul	NINTH DEVELOPMENT PLAN AND CHEMISTRY EDUCATION
T9P19	Draginja Mrvoš-Sermek	STUDENTS' UNDERSTADING OF THE BASIC CHEMICAL CONCEPTS IN PRIMARY SCHOOL IN CROATIA
T9P20	Marco Beeken	TALENTSPECIFIC PROBLEM-SOLVING-STRATEGIES IN CHEMISTRY EDUCATION
T9P21	H. Cihangir Tugsavul	THOUGHTS ON CHEMISTRY EDUCATION
T9P22	Ashraf Anaraki	STUDY ON RELATIONSHIP BETWEEN CHEMISTRY ACTIVITIES AND CREATIVITY INCREASE IN PRESCHOOL CHILDREN

T11 : Chemistry Education and Ethics

T11P01	Isabel Serra	ETHICAL PERSPECTIVES AND PHILOSOPHICAL PROBLEMS IN CHEMISTRY TEACHING
T11P02	Elif Caliskan	BONDS BETWEEN CHEMISTRY AND ETHICS WITHIN THE SCOPE OF EDUCATION

IMPROVING CHEMICAL EDUCATION: TURNING RESEARCH INTO EFFECTIVE PARTICLE

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Despite several decades now of research into the teaching and learning of science/chemistry at both 2nd. and 3rd. level, there has been relatively little impact on practice i.e. on the teaching of science or chemistry at 2nd. and 3rd. levels. In many countries interest in studying science at 2nd. and 3rd level is falling and there is concern over falling numbers and falling standards. There is a changing student population at 3rd. level - in many cases more diverse in ability and background, less well prepared in maths and science, and often less motivated, presenting problems of maintaining both adequate numbers of graduates and standards. Today's challenge is how to turn the findings of research on teaching and learning into effective practice, in other words, how to make the teaching and learning of chemistry more evidence-based, as distinct from its content. This has implications for the curriculum, for teaching methods and for assessment.

Much education research is never read and even less is applied, and this talk will look at some of the barriers to implementing the findings of education research and also some of the successes. At third-level, teaching needs not only to be subject research-led (a contemporary mantra) but also education research-led. Knowledge and understanding of subject content is vital for effective teaching but so is knowledge and understanding of the pedagogical knowledge related to teaching and learning a particular subject. This means that pedagogical concerns need to move from the periphery to the centre of our teaching, whether at 2nd. or 3rd. level, and cannot remain as the peculiar quirk of a few education-minded teachers or lecturers. In all this we must focus on the chemistry teacher or lecturer as the key to excellence and to effective educational change. There must be investment in the initial training, continuous professional development and on-going resourcing of teachers and lecturers if we are going to improve chemical education, and turn the findings of education research into more effective teaching. We must not try just to teach harder, we must teach smarter in the future.

SUSTAINABLE CHEMISTRIES: ENVIRONMENTALLY FRIENDLY AND ECONOMICALLY VIABLE!

Catherine T. "Katie" Hunt
??????????????

Environmental and economic goals are not mutually exclusive and, more to the point can be fully aligned through the application of green chemistry and green engineering principles. Moving forward, successful companies, universities and governments will understand that scientific collaboration and innovation are essential to making breakthroughs in the development of environmental and economic sustainability. Rohm and Haas is a two-time winner of the U.S. Presidential Green Chemistry Challenge Award. This award not only focuses attention on the fundamental work being done in our companies and universities but also celebrates the scientists and technologists, managers and leaders responsible for bringing these concepts from ideation through to commercial reality.
It will take all of us, working together, to create a sustainable planet. *So, let's get started.*

References

1. Anastas, P, and J. Warner. 1998. Green Chemistry: Theory and Practice. London: Oxford University Press.
2. Anastas, P., and J. Zimmerman. 2003. Design through the 12 Principles of Green Engineering. Environmental Science and Technology 37(3): 94A–101A.

THE LABORATORY IN CHEMICAL EDUCATION AND ITS ROLE IN THE LINKING OF THE MACRO WITH THE SUBMICRO LEVELS OF CHEMISTRY

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The chemical laboratory is the proper place for studying substances, their reactions, and their properties. Traditionally, expository instruction is used in the laboratory, with the students following cook-recipes procedures, which however are criticized for placing little emphasis on thinking. This presentation considers first alternatives to expository laboratory, such as inquiry and project-based laboratories, problem solving, context-based approaches, and student cooperative practical activities (Tsaparlis, 2008). Concrete experiences may be a prerequisite for a conceptual understanding of chemistry, but this understanding is eventually provided through the submicroscopic and symbolic levels (Gilbert & Treagust, 2008). The role of the laboratory and of the experiment in general in the linking of the macro with the submicro levels of chemistry is the second axis of the presentation.

Laboratory instruction is often presented at the macro level, with the basic aim to demonstrate laws and phenomena. Theory and the submicro level are then invoked to explain observations at the macro level, but experiments that demonstrate directly the macro-micro link are lacking.

Numerous studies have shown that students have great difficulties when trying to grasp concepts such as that of the molecule and the atom, that is, when trying to move from the macro to the submicro level, and vice versa (Tsaparlis, 1997). Connection of the macro level with the other two levels is an integral but difficult task, but this connection will contribute greatly to the development of thinking abilities in students (Georgiadou & Tsaparlis, 2000; Johnstone, 2000). Very important for this connection is the experimentation with gases. History of chemistry is of paramount importance here (Levere, 2001).

Many of the difficulties held by beginning chemistry students are due to the deficient understanding of the atomic model and how it is used to explain phenomenology and the laws of chemistry. Various attempts at building up a particulate model of matter by working from experimental facts are described. Finally, a text for eighth-grade chemistry in which the corpuscular concepts are delayed until the last third of the text and developed in seven lessons is reported.

References

1. Gilbert J. K. & Treagust D. F. (Eds.) (2008). *Multiple representations in chemical education*. Springer (in press).
2. Georgiadou, A., & Tsaparlis, G. (2000). Chemistry teaching in lower secondary school with methods based on: a) psychological theories; b) the macro, representational, and submicro levels of chemistry. *Chemistry Education Research and Practice, 1*, 217-216.
3. Johnstone, A. H. (2000). Teaching of chemistry – Logical or psychological? *Chemistry Education Research and Practice, 1*, 9 – 15.
4. Levere, T. H. (2001). *Transforming matter – A history of chemistry from alchemy to the buckyball*. Baltimore and London: John Hopkisn University Press.

5. Tsaparlis, G. (1997). Atomic and molecular structure in chemical education - A critical analysis from various perspectives of science education. *Journal of Chemical Education, 74*, 922-925.
6. Tsaparlis G. (2008). Learning at the macro level: the role of practical work. In J.K. Gilbert and D.F. Treagust (Eds.), *Multiple representations in chemical education*. Springer (in press).

SUSTAINABLE CHEMISTRY – A TOPIC FOR CHEMICAL EDUCATION

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Sustainability is an important topic for research and industrial developments in chemistry. Regarding education at school and university, sustainability can have two meanings [1]: On the one hand, students have to get an insight into demands and activities to improve sustainable development in society and industry. On the other hand, the students´ science education has to become more sustainable itself; studies such as TIMSS and PISA have shown that this is not the case in many countries [2]. The question that should be discussed in this talk will focus on these two directions: How could the integration of topics on sustainable chemistry improve the sustainability of science education?
We will present different approaches and topics that have been developed and tested either in secondary education or at the university level in Germany. One example is looking at the development of new technologies in the mobility sector, in particular discussing pros and cons of different fuels and fuel cells. On the bases of research and technology developments, context-based modules for secondary education have been developed and tested in co-operation between teachers and researchers in chemistry education [3]. A special focus has been set on the development of school experiments, for example to show and to explain the background of the greenhouse effect or to demonstrate the techniques of different fuel cells. Another focus has been set on the discussion of technological, societal and environmental arguments to strengthen the competence of judgment and evaluation [1].
A second example will give an insight into the use of alternative techniques in laboratories, such as using the microwave to carry out syntheses in inorganic and organics chemistry [4]. Again, teaching and learning material will be presented, including information about lab activities for secondary and tertiary education.
In addition to the presentation of different teaching and learning approaches, a critical reflection on the development of students´ competencies shall be discussed.

References

1. Menthe, J. & Parchmann, I. (2006). Von Anfang an: Nachhaltigkeit durch Chemieunterricht [Right from the beginning: sustainability in chemistry education]. In: Angrick, A.; Kümmerer, K. & Meinzer, L. (Hrsg.). Nachhaltige Chemie [Sustainable Chemistry], Marburg: Metropolis-Verlag. 115-128
2. http://www.mpib-berlin.mpg.de/pisa/DrawingtheLessons.pdf
3. Parchmann, I.; Gräsel, C.; Baer, A.; Nentwig, P.; Demuth, R. & Ralle, B. (2006). Chemie im Kontext – A symbiotic implementation of a context-based teaching and learning approach. In: International Journal of Science Education (IJSE) 28/9, 1041-1062
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ENGAGING THE STUDENTS WITH OUTSIDE-THE-BOX PEDAGOGY

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It is generally agreed that engaging the students in the education process enhances their learning. Yet, general chemistry courses, at least at most colleges and universities in the U.S., are lecture-dominated and instructor-focused with the students' role being simply that of a spectator. It is fair to ask why undergraduate students, even those who have developed devotion and dedication toward chemistry on the basis of their high school interests, should choose to pursue this subject given their experience. What message about our favorite discipline is offered by the approach that takes students' ability to solve numerical problems as the marker for their learning of chemistry? Where do the challenges of current research, the thrill of the discovery process, and the applications of chemistry to life, the environment, and energy solutions appear in today's 1,000-page general chemistry textbook-behemoths and all their ancillary material?
It is estimated that as many as 360,000 students enroll in first-year chemistry courses in colleges and universities in the U.S. every year. Many are premedical students and engineers; relatively few have already decided to major in chemistry. At the end of the usual four years of undergraduate education, approximately 11,000 students graduate with a concentration in chemistry or biochemistry; thus, the yield of this "reaction" is approximately 3%. Of these students, somewhat fewer than 2,000 (<20% yield) receive a Ph.D. degree in chemistry or biochemistry after another 5-8 years. Projections ten years into the future suggest that the number of Ph.D. degrees could drop to approximately 1,000 per year, which might not be enough to sustain the needs of industry and academia in an increasingly science-dominated and technologically sophisticated world. The challenge to chemistry education in the U.S. is to increase the undergraduate yield incrementally over the next years while economic, political, and educational forces change in other countries throughout the world.
Ultimately, the question boils down to what measures must be taken to increase the undergraduate yield from 3% to, say, 4%. In short, how to get more students to study chemistry at the post-secondary level. If the approach to teaching and learning of the past 20-50-100 years is unlikely to be sufficiently effective for 21st-Century students, different pedagogical approaches will have to be employed. The conventional pedagogy should be changed to incorporate more active learning, involve students in guided inquiry, and create textbooks that emphasize concepts and visualization rather than algorithmic numerical problem-solving. Engage the students and they will come to chemistry! Use outside-the-box approaches and you will get their attention!!

THE WISDOM OF PRACTICE: WHEN LEARNING IS GREATER THAN TEACHING

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As Einstein warned us, insanity is continuing to do things the way we have always done them, and expecting to get different results. In the ’90’s I put a lot of effort in my teaching as telling and learning as recall, but the students’ ratings of my teaching were disappointingly low. After reading a paper on cooperative learning [1], I understood I had to redesign the way I taught. In his Table of Learning, Shulman starts with ‘Engagement and Motivation’ [2]. If learning begins with student engagement, it is crucial to find ways to interest them in learning those things that we deem worthwhile. In my most recent course I corrected more than 6,200 solutions to problems from about 80 students. To date they have solved more than 7,000 problems; in addition, I collected about 920 concept maps and exchanged 300 e-mails with them. The majority of students enjoyed the course very much.

The first lessons are crucial for establishing a supportive and positive learning environment in the class. At the very first meeting, I collect the names of the students (to make cooperative groups), set multiple goals for the course, express my enthusiasm for learning, and voice my expectations that all students will learn much and many will learn ways of approaching problems that will carry over to all their other studies.

I use an approach that obliges students to spend more time analyzing the problem. The initial problems tackled were non-chemical and non-algorithmic to emphasize the analysis and synthesis operations without the interference of chemical concepts that students may not have mastered yet. In the second lesson, the groups (usually of three with the roles of *Problem Solver*, *Sceptic*, and *Checker/Recorder*) are formed and the drawing of concept maps is presented. At the start of each new lesson I collect the homework, which consist of solved problems and concept maps. As the problems and the maps are corrected, I congratulate the authors of the best solutions; I tell them the number of problems solved by each student and the errors made, and I give advice and suggestions on how to improve the solution and to check the result by verifying it. At the end of every new lesson, new problems and topics of the concept maps are suggested.

Students solve problems in groups, including problems on new topics. They must discuss and reach a consensus on the solution adopted. I collect the solutions and call a student from a group to go before the class and show on the blackboard how the problem was solved. Whenever necessary, I present and illustrate better strategies one can use for solving a certain problem.

This way of teaching is based on a personal relationship with the teacher and on the active involvement of students in their own learning: they know they are responsible for the results they achieve. The task of the teacher is mainly to inspire students because as Dick Zare said, “inspiration is more important than information”. [3]

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THE DISABLED STUDENTS AND THEIR TEACHERS - HOW TO OVERCOME THE DIFFICULTIES IN TEACHING AND LEARNING OF SCIENCE

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Persons with disabilities are fully entitled to participation in social life and equal treatment. This right was included in the Convention on the Rights of Persons with Disabilities adopted by the United Nations General Assembly on December 13, 2007. Article 27 of the Convention refers to education. The number of persons with disabilities in ordinary schools is systematically increasing. This is a result of two factors: improved diagnostics of health problems and creation of new possibilities of participation in the teaching process in a full-time and distant mode. We agree with respect to the fact that persons with disabilities can study. An issue to be discussed is determination of the borders of rational adjustment of the didactic process for the needs of such persons. This is a major challenge both for the authorities and the teachers, who are faced with the necessity of changing their previous habits. Discussions at the meetings of the teaching staff in a number of countries show existence of characteristic dilemmas:

Does acceptance of a person with a disability that prevents such a person from finding a job in their profession to study entail giving a false hope of employment after the completion of studies?

Should persons with disabilities that may constitute a threat to others during laboratory classes (e.g. epileptic attack whilst holding a flask with sulphuric acid) be permitted to participate in such classes?

Should the student inform the teacher about his/ her disability?

Are there no fears that a teacher, acting intuitively or having a limited professional knowledge, may harm the student rather than help him/ her?

Excessive concern for persons with disabilities, combined with leniency on the one hand and multiplication of obstacles and restrictions on the other, are, unfortunately, attitudes encountered most often among teachers and students in a number of countries. The situation of students with disabilities is very varied, even within the border of the European continent. With respect to education of persons with disabilities there are more questions than answers; however, thanks to international projects (e.g. Qa Train - Leonardo da Vinci), activities are undertaken that serve the idea of equal rights and possibilities of access to education, also education in natural sciences.

Useful links

http://scips.worc.ac.uk/ - SCIPS, a web based resource that provides **S**trategies for **C**reating **I**nclusive **P**rogrammes of **S**tudy

www.pl.scips.eu – Polish version of SCIPS

www.qatrain.eu - QATRAIN **Q**uality Assurance and **A**ccessible **TRAIN**ing, Leonardo da Vinci funded international project

www.uniwersytetydlawszystkich.pl – pilot project at Warsaw University (PL)

THE EUROPEAN PROJECT *PARSEL*: POPULARITY AND RELEVANCE OF SCIENCE EDUCATION FOR SCIENTIFIC LITERACY

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According to a European Commission report ‘Europe needs more scientists’ (2004), there is a poor image and a perceived irrelevance of school science impacts on students’ career aspirations. Science educators then need to modernise the educational approach to science (including chmeistry) education by making the school education through the context of science more acceptable to the students.

*PARSEL (*Popularity and Relevance of Science Education for scientific Literacy*) is a recent European Union Project*[2] *that provides relevant teaching modules in English but also in a number of other European languages. Some Aspects of PARSEL aims are:*

How to define Scientific Literacy?

Relevance to the objectives of the Science and Society Programme

Potential impact

The project sets out to make available additional, and model driven, teaching/learning materials and/or resources that are seen to relate to the enhancement of relevance in science education, as a step towards greater student uptake of science and technology related careers. While teaching/learning materials exist in all countries, and many can be considered exemplary, this project attempts to bring these together, under a common umbrella and to disseminate them linked to a model, after testing in a diversity of European education systems. It this way the project intends to guide teachers towards greater attention to relevance in the teaching of science subjects and hence the promotion of scientific and technological literacy**.**

Alternative teaching materials are already being made available to teachers, aiming at promoting student interest of science in schools without alienating the teaching from the curriculum intentions. To this purpose the following actions are currently under way: (i) translation of exemplar materials in various European national languages; (ii) testing and dissemination of these to teachers and other stakeholders; (iii) taking steps to meet the need for teachers to take ownership of the model through adaptation of exemplars; (iv) evaluation of the impact of this on teacher ownership of the model and student interest (paying particular attention to interest by girls).

The final aim is (a) to create a network community from those working in the field of developing teaching /learning materials and (b) to develop a model that encompasses the range of philosophical consideration and approaches that lend themselves to a general development of ‘best practice’ materials.

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[2] PARSEL is EU program within the *Sixth Framework Programme* /Science and Society Priority / Science Education and Careers 2005 /Coordination Action / Contract no 042922.

A total of fifty-four modules have been prepared, and these are available freely from the PARSEL Website:
http://www.parsel.uni-kiel.de/cms/
Chemistry is very-strongly represented in the modules. The titles of some of the chemistry-related modules are as follows (the first six are the ones developed by the University of Ioannina):

The gas we drink - Carbon dioxide in carbonated beverages
Salt – the good, the bad, and the tasty
Bathing and bubbling with chemistry
Brushing up on chemistry (toothpastes)
Milk - Keep refrigerated
Growing plants – Does the soil matter?
Can lake water be made safe?
Which soap is best?
Are we overusing plastics?
Do you need to know chemistry in order to be a good bones surgeon?
Should we do more to save monuments from corrosion?
How best to maintain a metal bridge?
No smoke without a fire - (Un)Desirable combustion
Which is the best fuel?
Zero emission cars– is it feasible?
Should vegetable oil be used as a fuel?

Keywords: *PARSEL* project, scientific literacy, school science, introductory chemistry, secondary chemistry

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T1O02

SHARING EXPERTISE, AN EXAMPLE OF TRANS-EUROPEAN CO-OPERATION IN FORENSIC SCIENCE - THE EDUFORMAK PROJECT

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Forensic Masters Degrees are not particularly widespread within Europe, the specialist training of suitably qualified scientific graduates of all levels by the major European forensics organisations being generally undertaken in house. This is largely historical since 'integrated forensic science' is a young science, and whereas the subject has seen an explosive growth in the UK, particularly at an undergraduate level, this has not been the case in the rest of Europe. Traditionally it was taught at master's level in the UK at a small number of universities and now such masters courses are beginning to expand into Continental Europe. However such development has been patchy and in some countries, worryingly where certain types of criminal activity are on the increase, there are no suitable courses available for students and in house training continues to be the *'de rigueur'*. Although this approach has much to commend itself, it generally relies upon one to one interactions between 'pupil and master' and requires that the 'pupil or learner' supports this interaction with appropriate reading. This learning however can be greatly enhanced and supplemented when local specialised university courses are available. Here the learner can not only have access to a wide range of literature but also to a greater number of experts who can enrich that learning experience. Bringing such courses on stream quickly in countries where they are needed demands co-operation on a Europe wide scale and this is what the EDUFORMAK project is designed to do.
The main objective of the project is the formation of a graduate educational system in forensic studies in the Republic of Macedonia so that it can satisfy all the necessary needs of the country's educational, legislative and internal affairs systems and is compatible with Bologna principles. To these ends, a 1 year 60 ECTS credits, post 4 year Bachelor, modular MSc in Forensic Science is being developed following the legislative tradition in Macedonia.
The proposed course will encompass both conventional scientific and social science principles of the subject, including practical issues such as crime scene investigation, forensic criminalistics and forensic medicine in addition to more theoretical aspects such as the legal system and legal issues in Macedonia. The course will have a common first semester and then split into 3 strands, one for students interested on physics/engineering, another specialising in chemistry/engineering and a third appropriate to biomedical/life sciences for the second & final semester.
The three consortia partners, Jagiellonian University & the Institute of Forensic Research, Poland, Nottingham Trent University, UK & Skopje University, Macedonia have the following common objectives and goals which they believe will enable them to deliver a sound and vibrant course for the next generation of Macedonian forensic scientists. Some studies (in the initial phase at least, will be conducted in partner countries).

T1- European Education Programmes and Projects

Accreditation and delivery of a new forensic MSc curriculum
Modernization and equipping the laboratories of Skopje University for forensic practical courses
Training and exchange of academic staff and students
Translating/publishing selected teaching material in Macedonian.

The presentation will give an account of the EDUFORMAK project to date.

TRAINING NEWLY APPOINTED UNIVERSITY CHEMISTRY TEACHING STAFF: A EUROPEAN SUMMER SCHOOL

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The training of new academic staff of all disciplines varies considerably throughout Europe. Some countries have highly developed schemes of formal training, often with assessment and accreditation, while others expect such staff to learn how to teach as they go along. In some countries with formal training this is done generically, and a frequent complaint of participants is that discipline specific aspects of how to teach are ignored.

In 2005 the Newly Appointed University Chemistry Teaching Staff working group of the European Chemistry Thematic Network organised a summer school for approximately 30 recently appointed university lecturers in chemistry. This is believed to be the first time that such a training event has been organised which is both international and subject specific. The event was repeated in 2007 in a very similar format.

This paper will discuss the factors which had to be considered in developing such a summer school. These included the demand for such an event, its content, location and timing, composition of the delivery team, recruitment, and the evaluation strategy.

The first summer school [1] ran with participants from 12 countries, and a team of 11 presenters from 6 countries. Workshops on practical classes, presentation skills, assessment, evaluation, context and problem based learning and supervision were supplemented with shorter lectures on European developments in chemical education, portfolios, European funding , widening participation and online resources. In addition, less formal evening sessions were held to discuss the European image of chemistry and the many roles of the teacher.

Informal feedback was collected during the summer school with a more formal questionnaire being administered at the end. Feedback was overwhelmingly positive, but did suggest a few changes to be made when it ran for the second time [2]. The list of topics covered remained essentially the same, but the short information delivery sessions were replaced by workshops. Also, only one evening session ran, with the topics covered being absorbed into the main programme. The second summer school was attended by participants from 11 countries, with a significant difference in distribution.

Both summer schools were supported by an online discussions group before and after the event. This allowed for introductions to be made online in advance, and for course materials to be posted. Delegates were also required to collectively write a set of proceedings for each event.

Feedback from the second summer school confirmed that its format continues to be successful. The two summer schools have been attended by a combined total of 56 delegates from 18 European countries. These facts suggest that this is a valuable event which should continue. The paper will conclude with a discussion of some of the issues which are involved in running future summer schools of this type. These include the need for a sustainable funding model, the widening of its geographical scope, and the possibility of obtaining a form of accreditation so that attendance is recognised by delegates' individual institutions.

Acknowledgements
Both summer schools were funded by the European Chemistry Thematic Network [3].

T1- European Education Programmes and Projects

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T1O04

TEACHING SCIENCE IN THE IRISH TRANSITION YEAR: A WASTED OPPORTUNITY

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The Transition Year Option (TYO) is an optional year between the Junior and Senior cycles in Irish second-level schools. There is no set curriculum and no examination. Teachers are free to teach what they like within the prescribed guidelines [1]. It is optional and was done by 524 second-level schools (71.3% of the total number of second level schools in the) and by 46.7% of students in 2006. This year provides an opportunity to teach science in an imaginative and relevant way, without the confines of a syllabus or an examination. The Transition Year Guidelines specify that *"Transition Year is an opportunity for pupils to become familiar with a broad range of science activities. Pupils should be encouraged to study areas of Science not heretofore encountered…Teaching/learning methods should stress pupil activity. Practical work should be more investigatory than is usually the case for Leaving Certificate courses."* [2]

Our study aims to discover how Irish science teachers are actually using this opportunity, what methods they use in teaching science, what their educational philosophy is and what teaching resources they are using.

A pilot study was conducted in 2006-07 in 17 schools in Co. Galway to find out what science teachers were doing during the Transition Year [3]. The findings showed that 61.9% of the teachers were teaching material from the Leaving Certificate courses (senior cycle), contrary to the philosophy of the TYO. Also, teachers were not aware of the range of resources that were available at that time.

Figure 1: Represents the percentage of teachers using published resources (Yes or No) [3]

We are extending this initial pilot study to all the schools teaching the TYO. In addition to collecting data on what science teachers teach, on their teaching methods and philosophy, we are also evaluating their use of two specific resources: TY Science modules produced at the University of Limerick [4] since 2003, (Cosmetic, forensic, Science of Sport, Science of Survival and Environmental Science) and resources produced by PharmaChemical Ireland (Forensic science, Cosmetic, science Microbiology, and Sports Science) [5], a body representing Ireland's pharmaceutical industry. This will be done through pupil and teacher questionnaires and interviews. We are currently testing a revised questionnaire in a second pilot study, which will then be extended to all TYO schools.

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T2O01

HOW DO CURRENT ACID-BASE DEFINITIONS AFFECT STUDENTS' UNDERSTANDING IN THE CONTEXT OF CHEMICAL EQUILIBRIUM?

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The objectives of this study were to explore the students' conceptions of acid-base concepts in the context of chemical equilibrium, and to determine whether the current acid-base definitions lead students to hold alternative conceptions about acid-base concepts. Sixty-two sophomore college students majoring in food science participated in the study in the year of 2007. The students received a questionnaire that involved open-ended items and consisted of four parts: (1) questions on acid-base concept, (2) questions on chemical equilibrium, (3) questions on acidity and basicity of an equilibrium mixture, and (4) questions on acidity and basicity of a solution. The data indicated that twenty-three out of sixty-two students achieved an appropriate understanding of acid-base and equilibrium concept. However, many of these students had alternative conceptions in the context of chemical equilibrium and believed that acid as a whole molecule makes the solution acidic rather than hydronium ion released in the solution. Students also indicated that acids and bases had no color; rather, acids and bases were capable of turning other substances into colors. The results of this study raise an argument that the current acid-base definitions themselves lead students to hold alternative conceptions in the context of chemical equilibrium.

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T2O02

STUDENTS' MISCONCEPTIONS ABOUT EXOTHERMIC AND ENDOTHERMIC REACTIONS

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The aim of this qualitative research was to inquire Finnish upper secondary school students' most typical misconceptions about exothermic and endothermic reactions.
Conceptions of Finnish upper secondary school students and teachers were collected using questionnaire. Students (n = 43, age 17 – 18) in two classes answered to questionnaire constructed using reported misconceptions attached to the subject. Additionally, upper secondary school teachers (n = 10) were interviewed using e-mail, and four Finnish upper secondary school books were analysed. In school book analysis attention was paid to find expressions which could be possible sources of misunderstanding regarding the energy changes in reactions. Results found in questionnaires were analysed in context of used school books and earlier reported misconceptions.
Misconceptions about exothermic reaction relate to energy changes during bond breaking and making [1,2]. The very common misconception is that energy is gained when chemical bonds are broken. According to Galley [1], students are misinformed or provided with conflicting information during their chemistry studies. The same misunderstanding of students was found in this study. Also, statement like bond making consumes energy was typical among studied students. However, chemistry textbooks used by students in our research clearly describe energy changes caused by bond breaking and making.
According to an earlier reported misconception, endothermic reaction was stated not to take place spontaneously [3]. In our study almost every other student undersigned this false statement. The textbook used in one of the classes studied explained the spontaneity of endothermic chemical reaction, but the another textbook did not. This had an effect on the mental models of students: the students in the latter class had much more often this misconception than the students in the other class.
Other troublesome concepts were the definition of concept enthalpy, the sign associated with enthalpy change, and classification of chemical reaction a endothermic or exothermic reaction.
Many earlier reported misconceptions coincide with the ones found in our study. Additionally, the textbook used does affect the build-up of misconceptions [4]. In future, interview studies could open the way to understand how misconceptions are built up. Effects of the chemistry textbook used in the class and its connection with apparent misconceptions should also be studied in-depth.

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T2O03

THE PERSISTENCE OF STUDENTS' DIFFICULTIES IN CHEMISTRY

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This study is the continuation of a study presented at the 2nd European Variety in Chemistry Education Conference[1]. This paper presents the findings of a longitudinal investigation that identified the Chemistry topics that the majority of Irish Chemistry pupils find difficult from Junior Certificate level (age 15/16 years) right the way through to University level (age 18+). It also looks at how Chemistry ability, Mathematics ability and gender influences the topics students find difficult or very difficult.

Students were asked to complete a questionnaire listing the topics covered in the specific courses that they had covered. They were asked whether they found each topic difficult or easy using a six point Likert scale. Each cohort of pupils: Junior Certificate pupils, Leaving Certificate pupils and University students, had a different questionnaire that listed the Chemistry topics appropriate to their Chemistry education at that point. In the second part of the questionnaire pupils and students were also asked to identify which five topics they found the most difficult in Chemistry. They ranked these Chemistry topics 1 to 5, with 1 being the most difficult Chemistry topic, 2 being the second most difficult Chemistry topic and so on.

This paper highlights the topics that Irish Chemistry pupils and students find difficult in Chemistry. Findings show that topics identified by Irish students are similar to the results of studies carried out in the UK by Ratcliffe[2] and Scotland by Johnstone[3]. At the Junior Certificate level, topics that pupils find difficult can be classified under the following headings: The Structure of the Atom, Bonding and Chemical Equations and Symbols. Responses from the Leaving Certificate pupils indicate that the majority of Irish pupils find topics such as Organic Chemistry, Chemical Equilibria Calculations and Volumetric Calculations difficult. At third level, Volumetric Calculations were identified by students as being the most difficult Chemistry topic. Findings also indicated that three topics ranked high in terms of perceived difficulty in both the Leaving Certificate Chemistry pupils and University Chemistry students' lists. These Chemistry topics were Volumetric Calculations, Redox reactions and Concentration of Solutions. The persistence of these topics being seen as difficult throughout the pupils'/students' experience of Chemistry indicates that problems associated with these topics have never truly been addressed. Hence pupils in their third year of Chemistry in College are still finding these topics difficult. Other findings indicate that the pupils'/students' Mathematics ability and Gender have an effect on the topics students chose as difficult or very difficult.

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T2O04

HIGH SCHOOL STUDENTS' LEVEL OF EXPLAINING EVERYDAY PHENOMENA BASED ON CHEMISTRY KNOWLEDGE

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MARMARA ÜNİ

In recent years, both worldwide and in Turkey worldviews shifting from objectivist to more subjectivist perspectives influence many aspects of life as well as the teaching methods. Relevantly, methods of increasing student motivation toward learning and their learning approaches also change. These changes are an important part of the reforms initiated in the field of education. Contrary to what traditional teaching methods would require, within recent reforms it is argued that motivation should be internal. One of the most important ways of enhancing internal motivation is to link what students learn with their everyday life. Also, for meaningful learning, students should be informed about the purpose of their learning as well as the fit of their scientific knowledge within everyday life. Furthermore, an important indicator of whether meaningful learning has occured is the extent to which everyday phenomena could be explained. However, it is an area of research to what extent and in which areas of chemistry, secondary school students can make explanations related with everyday phenomena.

The purpose of this study was to understand the extent to which secondary school students can make explanations regarding everyday phenomena related with the chemistry subjects in the secondary curriculum. To have a sample consisting of students who had studied secondary chemistry in complete we selected 332 senior high school students from different high schools majoring in science. Research instruments included an open-ended survey measuring level of explaining everyday phenomena, which covered all high school chemistry subjects. A second instrument was an achievement test with multiple choice questions aligned with those in the National University Entrance examination. Preliminary work was performed via a pilot study in which the validity and reliability of the instruments were established. For both instruments, Cronbach Alpha coefficients were found to be 0.89 and 0.77, indicating acceptable levels of reliability.

Findings related with chemistry achievement demonstrated an average student achievement score of 43.78 over 100. Compared with the students' chemistry course grades, the achievement scores were found to carry valid conclusions. The students' achievement varied across chemistry subjects.

Findings from the open-ended survey related with level of explaining everyday phenomena demonstrated an average student achievement score of 20.54 over 100. Student success in this domain showed large variability depending on chemistry subjects. The differences were analyzed within the subjects.

The findings of the study showed that secondary students failed to explain everyday phenomena adequately. However, their chemistry achievement level was much higher than their level of making explanations. In this sense, the students' lack of or poor explanation abilities may not be fully attributed to knowledge absence. This study offers a perspective for further research to elucidate influential factors in students' level of explaining everyday phenomena.

T2O05

DETERMINING MISUNDERSTANDING OF PRIMER TEACHER CANDIDATE ABOUT SEPERATION OF MIXTURE

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The alternative explanations and extreme generalizations in education lead to alternative conceptions [1]. Moreover, there are a number of abstract concepts in science, which increases the danger of forming alternative conceptions. Despite the advances as to teaching science, it is stated that most science teachers have alternative conceptions as students do [2]. The teachers' existing alternative conceptions affect the students' conceptual improvement in a negative way. Therefore, first of all, the alternative conceptions that teachers bear in their minds should be determined and fixed. In this study, the sophomore students in Primary School Department at Mustafa Kemal University are provided with the following task: "State the physical ways that can be used to dissolve the mixture of Sand-Stone-Salt-Iron Dust". In the analysis of the responses received, it has been detected that 33.8 % of the students have various alternative conceptions or misconceptions. Some of the alternative conceptions or misconceptions can be stated as follows: magnet has the feature of attracting iron, sulphur, etc., metals can be separated with the help of magnet; when you hold the magnet close to the mixture, the magnet attracts sand, two concrete substances can be separated from each other via magnet, sand and iron dust cannot be separated from each other as magnet attracts both of them, we can separate salt from stone via friction procedure, ebonite bar attracts sand, ebonite bar attracts salt, ebonite bar attracts iron sand; when water is added to the mixture of sand and salt, sand settles since it is heavier, salt is separated when the water is filtered; when the boiling water evaporates, salt also evaporates along with water, When ethyl alcohol is added to the mixture of sand and salt, salt is dissolved in ethyl alcohol so ethyl alcohol and sand remain only. Ethyl alcohol boils at 78 oC and there remains only sand. Stones can be separated by hand.
In the studies as to the students' comprehension of various science and chemistry subjects, it has been seen that even after the training related to the subjects is given, the concepts are not precisely understood by the students, the students explain the concepts in a different way and develop different opinions [4].In order to prevent the formation of such alternative conceptions, first of all teachers and teacher candidates should be trained.

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T2O06

STUDENTS' VIEWS CONCERNING PROBLEM BASED LEARNING

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The Course "Chemistry" is an applied course in which theoretical information is verified by experiments in laboratories including scientific processing skills, acquirements of chemistry-technology-society-nature, communication-attitude and value interactions besides critical thinking skills and life-long learning [3,15,13]. Since new information in chemistry instruction is widened continuously in recent years, having students skillful in accessing information should be primary aim rather than giving them information itself. Rather than making them memorize the content, students should be equipped with problem solving skills for new situations they face, their information accessing and information producing skills should be well developed as well [9].

PBL has a very important role in students' knowledge accusation [14]. In stead of traditional methods that are teacher centered and focused on teaching methods, PBL in which students take their own learning responsibilities on and based on real life problems is a student centered approach [2,4,5,6,7,10,11].

PBL has three important features ;

1. Having scenarios related to real life
2. Providing self learning
3. Supporting cooperation with group work

Scenarios related to real life are guides in reaching defined targets. In these scenarios, students come up with many problems and to solve them they bring out many multiple ways. Besides they are in the wish of learning [12].

Problem solving that involves self learning and problem solving skills is a process. In problem solving process, students define their pre-knowledges and ask questions whose answers they research actively. In this way, they take their own learning responsibilities on.

One of the important features of PBL is to make students work in groups of 5-7 with the control of the teacher. Students share their knowledges, debate their ideas freely and evaluate them. Being in contact all the time make their social skills strong [8].

The advantages of PBL are independence and freedom in the students' learning; deeper knowledge and comprehension oriented learning; personal growth. But, there are difficulties in balancing the depth and breadth of the syllabus and difficulties in finding assessment criteria [8].

To increase the effectivenes of PBL, we must take students ideas into consideration about PBL practices [1].

The aim of this work is to bring up students ideas about PBL. For this aim, students' views scale involved in getting students make research, attitudes towards the lesson, cooperative group work, self study learning, making connection with real life, teachers role in PBL factors applied 77 chemistry students at Dokuz Eylül University.

In the research, to define students ideas descriptive research model was used. The likert type scale having five options was applied the students.

The results of the study showed that the students were in general positive to continue to learn with the PBL program. The results from the research are tought to be useful for PBL studies.

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T2O07

INTRODUCING CHEMISTRY TO THE GENERAL PUBLIC: A WEB SITE

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Chemistry is beautiful. Chemistry strongly influences the world around us and its knowledge helps us to explain how the world around us works. With these ideas we have set up a web site:
www.whatischemistry.unina.it.
It's a common opinion that chemistry is about hard concepts and numbers and calculations. The main difficulties preventing its diffusion to the public are technicalities of the scientific language and abstract concepts. Chemical phenomena are in effect related with the sub-microscopic world and with energetic transformations: their visualization is hardly created in people's minds, due especially to the small size of matter components (molecules, atoms, electrons), and to the influence of phenomena unrelated to common life, like thermal agitation and energy exchanges. Sound theoretical bases on properties and behaviour of substances are required to produce reasonable representations.
In addition people feel that scientists see the world in a different way from common people and they talk about the world using a different language. This is partially true: the scientific language is concise, accurate, and univocal; in order to use it properly, however, it is necessary to learn its grammar. It has to be studied, like any other language.
We believe, however, that circulation of scientific ideas is vital for the advancement of both science and society. This belief prompted us to build a web site on Chemistry, with pages written in a plain language and readable by non-specialists. Chemical phenomena are discussed starting from common experiences, in order to make the basic concepts easier, without giving up scientific rigor. In other words we have tried to introduce some of the important issues in chemistry, without requiring any specific background in Science nor any previous practice with scientific language.
The ambitious goal is to combine two targets: accuracy of scientific information and easy readability. Each page has been written by professors of the University of Naples "Federico II" and by researchers of other institutions in the same area, all deeply expert in the specific topics. The style of the presentations and the language have been particularly cared, with the aim of being comprehensible to every reader provided with a general scientific curiosity and an average culture. Technical terms are limited to those strictly necessary, and each of them is explained with simple words.
The site is not an exhaustive learning tool. Its aim is limited to arouse interest and excite curiosity in occasional readers. It is fully written in Italian and in English, because it has been developed in Italy but it is addressed to an international audience. The site is continually updated, with new contributions being added regularly. We solicit contributions from persons from any country, who may share the approach we adopted. New contributions shall be subject to a thorough review by Site Editors, to ensure that the main characteristics of the site, especially scientific rigor and easy language, be consistently preserved.

T2O08

THE LEVEL OF STUDENTS' COGNITIVE INTEREST IN THE CONTEXT OF NATURAL SCIENCES EDUCATION

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The tendency to direct the teaching process to student's needs and interests, using the student - centered approach is becoming a more and more rising trend in natural science education [1-3].
In the recent years students' interest in natural sciences including chemistry has a tendency to decrease in Latvia [4, 5]. A survey was carried out to determine students' level of interest in obtaining knowledge on natural sciences and chemistry.
Totally 233 students (117 girls, 116 boys) of grade 9 tooks part in the survey from 8 schools of different regions of Latvia. The survey was carried out in December of the school year 2007./2008.
A questionnaire was carried out and 20 closed type questions were used. All the questionnaire questions were distributed in two thematic clusters:

§ *Observations in nature (nature phenomena, plants and animals in my surroundings, environmental pollution, sewage waters in a city, drinking water, global warming a.o.)* (coded General)*;*

§ *Chemical substances and processes in nature and surroundings (physical and chemical transformations a.o.* (coded Chemical).

The most interesting topics as admitted by students are: *Drinking water quality* ($M_{average}$=3.31), *Sorting of waste* ($M_{average}$=3.25) and *nature phenomena* ($M_{average}$=3.06). Obtaining knowledge on chemical processes was acknowledged as the least popular ($M_{average}$=1.82). Differences are depending on gender (Pearson correlation 0.87). When analyzing question clusters General ($M_{average}$=2.64/ mode 4) and Chemical ($M_{average}$=2.32/ mode 1), results show that girls are more interested in general topics ($M_{average}$=2.71), and less in chemistry topics ($M_{average}$=2.24). This difference is smaller for boys (accordingly in general topics $M_{average}$=2.57, in chemistry topics $M_{average}$=2.41). Girls have comparatively higher level of cognitive interest than boys.
Results suggest that the overall students' interest in natural sciences and chemistry is of average level, although at individual topics students show comparatively high level of interest. Students have higher interest in essential everyday issues and global problems. Students have low interest in understanding chemical processes. On the whole it can be concluded that interests are shallow.

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T2O09

THE CHALLENGES OF TEACHING LARGE CLASSES - INCLUDING THE PROVISION OF SELF DIRECTED FORMATIVE LEARNING

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The cohort in the largest first year Chemistry course (> 1400 students) at the University of Auckland is not only diverse in future program choices but also in their educational backgrounds. This diversity and the constraints on staff and resources bring challenges for course delivery and the course co-ordinator.
Over a number of years formative learning activities have been developed and implemented though the web environment using Bestchoice (an interactive learning system). http://bestchoice.net.nz modules [1].
The model underpinning BestChoice learning activities is simulation of the interchange of a student with an experienced teacher. Thus, student responses on BestChoice question pages generate instant assessment and feedback. BestChoice is innovative in its emphasis on teaching both concepts and problem-solving strategies by guiding students in ways that promote their understanding.
The structured implementation of course modules, some of which contribute towards student assessment, will be outlined. Student feedback and the course co-ordinator's perception of the value and contribution to student learning will be reported.

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T2O10

PHENOMENOGRAPHIC STUDY OF PROBLEM SOLVING IN CHEMISTRY UNDERGRADUATES

Tina Overton and Nicholas Potter
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Phenomenography aims to qualitatively categorise a person's experience of certain phenomena. Phenomenographic research can produce a set of categories that describe how individuals experience, perceive or conceptualize a phenomenon, a concept or an activity. The important factor is the relationship between the phenomenon and the individual's experience of it.

Working with a number of students from a range of year groups we have recorded and analyzed hour long individual problem solving sessions in order to determine the different approaches to problem solving. In each hour long session the participants were given up to three open-ended context-based chemistry problems. A facilitator was present to prompt discussion about each problem and to encourage the participant to verbalize their thought process. The participant would, at the same time, use pen and paper to work towards an answer to the problem. The interviews were then transcribed and analyzed using NVIVO software to qualitatively categorize the different approaches to problem solving.

T2O11

DIFFERENT TEACHING METHOD FOR ELECTRONIC CONFIGURATION: AN ANALOGY ACTIVITY

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Researchers in science education have been looking for better ways of teaching and learning for decades. These efforts have brought out many materials, methods and techniques. POE (Prediction – Observation – Explanation),creative drama, concept cartoon, flash card, drawing, model, poster, game, story, V-diagram, concept map, fortune line, relational diagram, word association, knowledge - classification map, conceptual change text worksheet and analogy can be counted as examples of them. Some of the teachers are aware of these materials, methods and other techniques and make use of them in their classrooms. The aim of using these materials, methods and other techniques is to have students to develop better understanding of science and lasting learning. Therefore, teachers' use of these different materials, methods and techniques should be encouraged in teaching to improve the quality of learning. One of the ways of teaching is the use of analogy activities during lessons.

In this study, researchers designed an analogy activity for teaching electronic configuration. There are two reasons of choosing electronic configuration. First, one of the researchers works in a high school and has personally faced problem about teaching this topic and second, because it is one of the fundamental topic in chemistry and students who understand this topic well increase the chance of being successful to learn anion, cation and chemical bond concepts.

The research is done in multi-program lycee. Quasi experimental design was employed. Researchers chose two classes randomly as experimental group and another two classes as control group from the lycee. Before instruction one of the researcher made observations on students' level and indicated no difference between the classes. In control group students were instructed with traditional method. In experimental group teacher instruct with a designed analogy activity. In analogy, electron configuration system is likened to a school in which students will located themselves in a short time by wasting minimum energy. The school (in analogy) was identified clearly by exhibiting sketch. Similar and dissimilar parts of analogy were represented in prepared analogy map. Research data were gathered with observations (pre-during instructions) and open ended question tests (post instruction).

Result of the research showed that the students in experimental group were more successful than the students in control group. It is suggested that analogy activities should be developed for other topics of science.

Key words: Electronic configuration, analogy, teaching material.

T2O12

A MULTIDISCIPLINARY APPROACH - DOES IT ENCOURAGE ENGAGEMENT WITH ALL THE SCIENCES

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First year undergraduate science students (particularly in Chemical and Biological programmes) generally attend the same lecture and laboratory modules in introductory Chemistry, Physics, Biology and Mathematics, regardless of their ultimate degree programme. However, students generally do not see the links between these subject areas and in some cases, even question the relevance and importance of some disciplines for their future studies. Allied to this problem is the fact that much of modern scientific research is now 'interdisciplinary' [1].
Much research has been carried out on first year undergraduate chemistry courses [2], and in particular approaches (e.g. problem-based learning [3,4]). However, interdisciplinarity and indeed multidisciplinarity in science may have a place in general science courses. Taber has addressed issues relating to interdisciplinarity in physics and chemistry [5] and van Hecke et al have used an interdisciplinary laboratory to show commonality of investigative methods and laboratory techniques [6].
This project sought to engage first year undergraduate science students following 7 different degree programmes (from Biotechnology to Pharmaceutical Sciences) in solving multidisciplinary problems. Each problem was carefully constructed to include elements of physics, chemistry and biology. Problem themes included topics such as nuclear energy, brewing, water treatment and environmental issues and each problem required different outputs for assessment e.g. preparation of a poster, short debate, scientific report, or development of recommendations for government. It has been argued that there is a need to create special chemistry courses or curricula for students with differing aims and /or professional objectives [7]. However, in this project, all students over the 7 programmes undertook the same range of problems in small groups.
Detailed analysis of student feedback, over two year implementation with over 300 students, will be presented in this paper. Particular focus will be on the development of the problems and students views of their own engagement with the module, their learning and their general views of the problems and the approach.

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T2O13

SCIENCE STUDENT TEACHERS' VIEWS CONCERNING CHILDREN'S LEARNING DIFFICULTIES, AND THE TECHNIQUES OF IDENTIFYING MISCONCEPTIONS

Yasemin Godek Altuk
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This study was carried out to enhance the awareness of science student teachers about children's learning difficulties and the techniques of identifying children's prior knowledge and misconceptions. This study was carried out in three phases. In the first phase, in 2006-2007 academic year at spring term, 172 student teachers were taught about 10 techniques of identifying children's prior knowledge and misconceptions in the scope of Special Teaching Methods Course-I. In the second phase, in 2007-2008 academic year at winter term, each student teachers were given one science concept and then asked to study with children in primary schools and identify their prior knowledge and misconceptions by using two techniques. Student teachers individually studied on 35 science concepts and prepared individual reports by pointing out the techniques they have used, the ways in which they applied these techniques, their own views concerning the advantages and disadvantages of these techniques, their findings and the contribution of this practice on their knowledge base. Student teachers also made oral presentations about their experiences and findings to their classmates. In the third phase, at the end of winter term, student teachers' views were sought through questionnaire including both likert scale and open ended items. 168 student teachers from 172 participated to this questionnaire. Briefly, the data collection methods were student teachers' written reports and the questionnaire. While majority of student teachers preferred and used drawings, written views and explanations, minority used posters, prediction-observation-explanation (POE), interviews, and relational diagrams in identifying children's misconceptions. However, prediction-observation-explanation (POE), card sorting and concept maps were found as the most useful and interviews, written views, and posters were found as the less useful techniques by student teachers. When their views concerning the advantages and disadvantages of these techniques were analysed, they mainly pointed out the advantages. Student teachers mainly stated that this practice led them to be aware of the reasons of children's learning difficulties and misconceptions, the appropriateness of the techniques to the topic, and children's individual differences. Moreover, student teachers made some promising suggestions about overcoming children's misconceptions and teaching of science. The research findings show that student teachers' active participation in identiying misconceptions seems useful in developing their knowledge base since it enhanced student teachers' awareness concerning children's learning difficulties and identification of misconceptions.

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T2O14

A NEW APPROACH TO IMPROVING SCIENCE LITERACY

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ISS "Insegnare Scienze Sperimentali"1 (Experimental Sciences Teaching) is a National Plan born by the synergic effort of different actors: the Italian Ministry of Public Education, three Teachers Associations of Physic, Natural Sciences and Chemistry (DDSCI) and two Science Museums in Milan and in Naples respectively. The goal is to improve science education through an effective change in Science Teaching2 providing Science Teachers with an effective and innovative inservice training.
The Pisa outcomes showed that Italian students do not perform very well in Science; in Pisa3 2003 they scored 486 (the average score was 500) which made them 27th out of 40 Countries and in Pisa 2006 performance was even worse.
ISS Plan aims at enhancing Scientific Literacy in all the compulsory school levels (age 5-16). The Teachers in-service training is based on peer education and research-action approach. Key points of the Plan are: laboratory (laboratory work and laboratory of ideas), competencies (enhancement of literacy standards), authentic learning (learning in context to make sense out of the topics) verticality (to develop continuous curricula over different school levels), integration of disciplines (in order to provide a unified scientific framework) and communication (to share experiences). The themes developed are four: "Transformations", "Read the environment", "Light, colour and vision" and "Earth and Universe". The Plan is largely embedded into the social context in order to link formal and informal Education Environments and to promote cooperation between schools, local industries, Science Centers, Museums and other learning resources. In the context of the new scholastic autonomy the "Indicazioni per il Curricolo"4 set the students' competencies to be achieved but leave to each School the responsibility of designing the Curricula. The teachers' inservice training is relevant to promote their capability to design effective educational projects. ISS provides an in-service training for expert teachers that will act as tutor for other teachers who will meet and work together in the "Presidi", Schools selected in each Region all over the Country. Furthermore the opportunity to share experiences, exchange ideas and give support is provided by an on line environment. The ISS Plan started with National Seminars to train the expert teachers. The Plan is administered and monitored by the "Gruppo di Pilotaggio Nationale" (GPN or National Pilot Group) and the Scientific Committee that work at National level setting the general criteria and Regional Pilot Groups and Presidi that work at Regional and local levels. The work is in progress and the exchange of experiences and materials using the ICT and the online environment has just begun. The aims are very innovative, the tasks are very demanding and the work to do is impressive and it will take a long time to get significative outcomes. We hope the Plan will be supported for an adequate period of time to make it useful for the Italian Science Education Community.

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T2O15

MOLECULAR ANIMATIONS AND STUDENTS' MENTAL MODELS OF CHEMICAL PHENOMENA AND PARTICULATE REPRESENTATIONS

Jerry P. SUITS
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Most practicing chemists have vivid, well-organized visual images of chemical phenomena and the corresponding particulate representations at the molecular level [1]; however, many students lack the experience and ability to form these visualizations without expressing misconceptions [2]. In this paper, I will present examples of molecular animations and the corresponding mental models drawn by students that show a diversity of misconceptions, scientific conceptions, and a mixture of these two types. Some students can draw sketches, which give the appearance they know the underlying concepts; however, if they cannot explain their drawings, then they do not understand them [3,4]. Molecular animations can be designed to challenge students' misconceptions; however, animations can often be misinterpreted, which can result in the formation of new misconceptions. Some features of animations can be adjusted to minimize the formation of misconception and to allow students to generate the appropriate scientific conceptions. For example, narration (voice over) often allows students to focus on the important features and to visually track the dynamic sequence while minimizing distractions [5]. Chemical phenomena or the underlying molecular interactions shown in the animation should be broken down into stages, called segmentation [6] so that students can develop appropriate mental models that show an interconnected series of changes at both the observable and molecular levels. These design features of molecular animations and student-drawn mental models will be illustrated with examples from topics such as intermolecular forces, organic extraction, and protein denaturation. This research project was supported by a grant from the National Science Foundation (NSF Award # 0440103).

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T2O16

FORMATIVE AND SUMMATIVE ASSESSMENT OF STUDENT UNDERSTANDING IN THE GENERAL CHEMISTRY CLASSROOM

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Several challenges confront instructors of first-year university science major students in the United States that are due in part to lowered expectations and grade inflation at the pre-university education level. As a result, many students entering a university general chemistry course designed for science majors tend to be naïve about the amount of study time required to excel at the university level and their preparedness to attain grades that they deem satisfactory. Because many students have not dealt with a challenging curriculum that introduces them to problem-solving exercises that require sound conceptual understanding, the ability to draw upon appropriate mathematical problem solving skills, and how to deal with problems that deviate from algorithms presented in class, many students have a narrow tolerance of failure in problem solving. Traditionally we measure student performance with a limited number of examinations and quizzes throughout the semester, but these instruments produce information about student performance too late to make changes in the study behaviors and outcomes of many students.

Two tools for dealing with these challenges will be discussed in this presentation: 1) classroom response systems, also know as personal response systems or "clickers" and 2) an on-line, graded homework systems. These allow for daily assessment of student performance and timely feedback to students about enhancing their conceptual understanding and mathematical problem-solving skills. The information presented will be for a generic personal response system, but the on-line, graded homework system described will be MasteringChemistry™ Discipline-Specific Student Access Kit introduced in 2007 year by Prentice Hall.

These tools were used in a complimentary fashion at Butler University, a comprehensive university of 4000 students, with a general chemistry class of less than 100 students, most of whom were majoring in a science in preparation for a career in pharmacy, medicine, biology, chemistry, physics, or engineering. Two similarly enrolled classes will be compared by their relative performance on the American Chemical Society Examinations Institute Examination on General Chemistry, used as a final examination at the end of the two-semester course. Both classes used the same textbook and laboratory manual, had similar homework assignments, and used classroom response systems, but only one used MasteringChemistry. Student feedback about using MasteringChemistry will also be given.

T2O17

HOW TO TEACH QUANTITATIVE ANALYSIS ?

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Introductory courses usually contain parts on Quantitative Analysis. The subjects taught and the relative amount of time taken on each topic vary greatly. Should the focus be on equilibrium chemistry, on introducing modern analytical instrumentation or on solving real-world problems in a research team? Currently these questions are intensely discussed both in Europe [1] and in Northern America [2]. The approaches differ considerably. One common property is easily observed: most universities cannot afford to offer a suitably broad course on modern analytical instrumentation and problem solving.
"Eurocurriculum II for Analytical Chemistry" [3] may serve as a tool to widen the bottleneck. The current goal is the development of a set of case studies, whose topics correspond to the content of "Eurocurriculum II for Analytical Chemistry". The Division of Analytical Chemistry (DAC) of EuCheMS and the the Institute for Reference Materials and Measurements of the European Joint Research Center Geel/Belgium [4] combined their forces in order to achieve fast progress.
Here we present some common factors among quant courses and summarize some of the basic subjects for the development of the case studies.

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T2O18

CAN CHANGING THE PEDAGOGICAL APPROACH RELATED TO THE MOLE CONCEPT IMPROVE STUDENTS' PROCEDURAL AND CONCEPTUAL UNDERSTANDING OF THE MOLE?

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One of the fundamental concepts covered during the first-year undergraduate chemistry course is the mole concept. It is envisaged that through a series of tutorials, lectures and laboratories that students will develop a procedural and conceptual understanding of this concept. Johnstone states that there are three levels of knowledge – the macroscopic, the symbolic and the microscopic [1].The microscopic and symbolic levels are thought to be directly linked to each other with the knowledge of one improving performance in the other.
The mole concept involves the application of mathematics which is a great source of difficulty to many students [2]. With procedural calculations, which are the type involved in molarity, the student begins with the information in the problem statement and works forward, performing operations until the required goal is reached [3].
This study aims to compare 1st year chemistry students' understanding of the mole concept at both a conceptual (microscopic) and procedural (symbolic) level for both 06/07 students and 07/08 students.
The first-year undergraduate science students of Dublin City University all take a laboratory module in Chemistry. This student group are heterogeneous in that up to half have no prior chemistry knowledge while the other have completed chemistry to second level. Also, students are pursuing a variety of different vocations in the world of chemistry.
While the concept of the mole and molarity are introduced over the first three weeks of laboratories, throughout the last two years, the methodology has differed while the assessment remained the same. After six weeks, the students complete an in-lab examination (exam 1) which involves conceptual and mathematical calculations. After a further twelve weeks of labs, students completed another lab examination (exam 2). At the end of the year, students were given a conceptual-focused questionnaire with regard to the mole concept based on the work of Howe & Krishnan [4] and Treagust [5].
In the first year (06/07 students), the approach towards the introduction of the mole was focused on recognizing the relationship between the number of particles of an element and/or compound and its atomic or molecular mass and ultimately relating this understanding to the mole concept in terms of molar mass and molar volume.
Students also completed a problem with regard to differentiating between atomic ratio versus mass ratio. Conversely, in the second year (07/08) the emphasis was placed on mass ratio versus number of particles, using mass ratio to determine an unknown number of particles. This was followed by extrapolation to determining the number of atoms/molecules from mass ratios.
Students' results with regard to the procedural aspects of the mole concept incorporated within the laboratory exam for semester one, reveal that neither cohort of students performed particularly well on this calculation, with less than 50% of either cohort completing the calculation correctly. However, when the same cohorts were given solutions of $CrCl2$, a large number of both cohorts could identify an increase in concentration while this percentage decreased significantly when asked to correctly link number of moles to volume of solution.

Results of the conceptual questionnaire suggest that both cohorts have quite a low conceptual understanding of the mole, independent of the methodology applied. However cohort 1(06/07 students) outperformed cohort 2(07/08 students) on two of the learning objectives, with cohort 2 providing the highest percentage of correct answers of the entire questionnaire (61%) on one of the learning objectives.
Upon further analysis of the data obtained from both the questionnaire and examination, it is believed that the more revealing information will be obtained from the incorrect answers provided by the students. While the modifications made to the current lab have slightly improved the procedural and conceptual understanding, this model is still not perfected. Results and answers provided by this study hope to provide essential information which will help to build upon and improve on the existing model.

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T2O19

INNOVATIVE TEACHING OF CHEMISTRY

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The progressing ICT made our suroundings change tremendously. This new revolution brings us from the industrial era to a new level of cultural development, i.e. information society. Information society is a popular term today, one that tries to define modernity [1]. A new lifestyle is born, creating mobile, media people. The task of 21st century education is to raise flexible, active, adaptive people, capable of living in a multicultural world of new ICTs, synthetized information [2], where omnipresent media influence changing mentalities in societies, including changes in teaching and learning methods.
Responding to these challenges, teachers of natural sciences, contrary to the teachers of other subjects, tend to be better at getting acquainted with technological novelties. In order to facilitate their work, the Department of Chemical Education, operating within the Faculty of Chemistry at Adam Mickiewicz University (AMU) in Poznań has been involved in preparing computer programs facilitating teaching chemistry at all educational levels and, since 2005, it has been working out a strategy of teaching natural sciences which uses an interactive display board. The board, similarly to any other new didactic tool, underwent scrutiny verifying its educational value and inspecting the ways of its possible us [3]. The research on the interactive display board's value carried out by AMU Department of Chemical Education is one of the first examinations of this type in Poland [4]. We also teach classes and conduct teleconferences using interactive boards. This technology is used in:

- teaching at primary;
- teaching in junior high schools;
- teaching in high schools and vocational high schools;
- teaching academic students;
- teacher training classes at postgraduate courses.

Some of the classes taught by us were recorded digitally and published as CDs, while the compiled scenarios were uploaded onto the websites of Wydawnictwa Szkolne i Pedagogiczne (WSiP) [5] or Partnerstwo dla przyszłości (section Chemia) [6].
Modern interactive education utilizes ICT tools and solutions. The advantage of these solutions is the possibility to conduct classes in specialist subjects, such as chemistry, for interested parties, withouth having to travel to distant locations. This form of teaching can be particularly beneficial when organizing interactive lectures and classes, for students and postgraduate students, taught by world renowned scholars, as well as when exchanging know-how between educational centres. This solution is also innovative because of the fact that, despite various types of teleconferences had been organized before, it was only after the interactive board was applied that several actvities could be performed simultaneously, eg. writing equations of chemical reactions, creating joint files, filling up diagrams, taking tests. Thus, people staying at very remote places, sometimes even hundreds or thousands kilometers apart, could fully interact with one another. This is the first such didactic solution in Poland, and one tha can be successfully applied not only in education, but also during trainings and conferences.

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T2O20

HOW TO REDOUBLE PUPILS' MOTIVATION? - CRIME SCENE INVESTIGATION EXERCISE

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Forensic science has emerged as a significant element in efforts to control crime while maintaining a high quality of justice. The value of physical evidence and its analysis has been demonstrated in many occasions, and low enforcement official have become increasingly dependent on laboratory results for evidence not obtainable by other avenues or means of investigation [1]. The connection between forensic science, especially the real forensic chemistry applications with the pupils theoretical knowledge, which their obtained at school is a great idea for redouble their motivation for teaching chemistry and gets their attention. Pupils have easy access to found any type of crime via the mass media and the internet so they know the background of a variety crimes. The most important roll for chemistry teacher is of course not to be discussed about the crimes but how we can detect the traces and how we can use our chemistry knowledge for solving the case. Moreover this kind of connectedness occurring in study courses are very often used by the famous wets universities to catch the students who have strong interest specially to the nature science.
A workshop devoted to forensic chemistry were prepared in the framework of international project CITIES and evaluated with the group of teachers in Poland. The module methods is proposed. It consists of six experimental stands and two theoretical stands. The experimental stands include: detection of fingerprints by means of powders, dying dactyloscopic traces with iodine (or ninhydrin, cyanacrylates), securing shoe-, foot- and vehicle traces, invisible inks and forgery of documents, detecting traces of blood with luminal, reproduction of ground-down numbers and letters [3].
The module method consists in performance of a series of actions (tasks, modules) by groups of pupils. The results of individual actions serve to determine the mutual relations between the constituent elements of a certain entity (the topic of a given class). Individual activities (chemical experiments, working with text, etc.) fulfil various functions in the method, constructing an outlook on the problem as a whole [1]. In the module method, the pupils perform tasks in small groups (2-3 persons), passing from one stand to another. At the beginning of the class, the pupils select the stands in an arbitrary manner, yet each group has to find one stand (alternatively, the initial stands are assigned to the groups by the teacher). The groups of pupils perform a task that they encounter at a given stand and record the result on a work sheet which they carry with themselves. Upon the teacher's signal (or after the completion of a task), they change stands and go on to another one (in a clockwise direction or to another stand that is free at the given moment). After completion of all tasks, the work is summed up in a form proposed by the teacher, e.g. oral presentation of results obtained at individual stands (or a presentation with the use of a projector).
CITIES (Chemistry and Industry for Teachers in European Schools) is a Socrates programme for the year 2006-2009. CITIES will design, test and deliver a European modular in service teacher training programme for chemistry teachers in 5 different languages with parts published in three more languages CITIES aspires to innovate in the development of partnership approaches between teacher training institutions, chemical industries and social partners, where universities act as catalysts. The course modules for teachers shall not only

transport information, but also change attitudes and increase awareness of teachers as multipliers and guides to their pupils. CITIES partners are: Europa Fachhochschule Fresenius, University of Applied Sciences (DE), Czech Chemical Society, German Chemical Society, Royal Society of Chemistry, Institute for the Didactics of Chemistry, Frankfurt University, ECEG - European Chemistry Employers' Group, EMCEF - European Mine, Chemical and Energy Workers' Federation, University Ramon Llull (S), Jagiellonian University, Nottingham Trent University (UK).

Detailed description of experiments and comments of group of chemistry teachers from Krakow (Poland) who participate in pilot workshop entitled "How to redouble pupils' motivation? - Crime scene investigation exercise" will be presented.

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T2O21

A COMPARATIVE STUDY OF NONSCIENCE MAJORS' & SCIENCE MAJORS' MOTIVATION TO LEARN CHEMISTRY, THEIR VIEWS ON CHEMISTRY AND SOCIETY

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Learners in the field of science education are generally directed to have an overview on science and society together in a meaningful context so that growth occurs in all three educational domains: cognitive, psychomotor and affective. Varieties of large scale studies provide a huge and rich amount of data that indicate there is good reason to be concerned about affective factors. Numbers of substantial theoretical models and perspectives have been advanced over the years in order to account for, historical background, theories, correlations and consequences of motivation. Also there are many studies exploring the attitudinal and motivational constructs viewing together since they are closely linked to science learning. Focusing on the outcomes of science; carry us to investigate students' motivation to learn chemistry in different majors. In this study, a theoretical model developed by S. M. Glynn, G. Taasoobshirazi and P. Brickman (2006) and their Motivation to Learn Science Questionnaire (SMQ) took the main frame. The study investigated 67 nonscience majors' and 68 science majors' motivation to learn science by a Likert-type instrument with thirty items. Factor analysis was computed to see whether the instrument is working in same way across the cultures or not. The factors' loadings were different from its original and an independent sample t-test analysis was computed to find out the difference between group means. Analysis indicated that total motivation scores of science majors are higher than that of nonscience and it is significant at 0,05 level of significance. Also correlation between gender, motivation to learn science and achievement was found. Three science majors and three nonscience majors' students were interviewed semi-structurally about their views on chemistry-society and they were also asked how they find chemistry relevant to their field. Qualitative data enabled us to see deeper insight into students' motivation to learn chemistry and their views on relation of chemistry to real life and their fields.

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T2O22

FROM AVERAGE VALUE AND STANDARD DEVİATION TO FLUCTUATION , DIFFUSION, RANDOM WALK / BROWNIAN MOVEMENT, UNCERTAINTY PRINCIPLES, ENERGY OF HELIUM ATOM AND BIG BANG THEORY

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Every Chemistry student is familiar with terms significant figures, accuracy, precision, error, average value and the measure of error – standard deviation. They are, however, not made to realize that this measure of error, standard deviation, is a very fundamental quantity and concept as well. With this standard deviation are associated phenomena / quantities like fluctuation, normal distribution, random walk / Brownian movement, diffusion, spread of wave packet, the various uncertainty principles including Heisenberg uncertainty principle, and big bang theory. Chemistry students are also not aware that the ground state energy of helium-like atoms can be estimated using Heisenberg uncertainty principle.
Thus starting from the simple definition of this measurement of error - the standard deviation - an a attempt is made here to make Chemistry students realize that the above mentioned phenomena are related to or can be considered as manifestation of this quantity of error.

Key words: standard deviation, fluctuation, random walk, uncertainty principles, Helium atom energy.

T2P01

DYNAMIC PATTERNS IN TEACHING CHEMISTRY

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According to a well-known definition "Learning is the change of behavior as a result of experience". Therefore, the behavioral changes originated from growth and maturity can not be taken into account as learning.

Learning is not confined to school, but it occurs always and everywhere in a continual manner, and its process can be affected strongly by some factors such as background, stimulus, learning goals, learning strategies, the environmental circumstances, the teaching methods, and practice.

In this article, besides the examination of the factor of "Interaction" and its role in learning, some dynamic patterns in teaching chemistry and the methods that can conduct them in the class are explained. In most of these methods, "IT" has an undeniable role in simplifying the material and delivering it to the students in an understandable manner. In each part the results are discussed with examples.

T2P02

UNCHARGED TRIVALENT CARBON IN NON-RADICALIC MOLECULAR STRUCTURES ACCORDING TO THE VALENCE BOND THEORY

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Can carbon be trivalent? In other words, are there any compounds where carbon takes part in the formation of only three bonds, instead of the usual four? Well, though rather uncommon, yet molecules where carbon participates in less than four covalent bonds do exist. Here we skip divalency (as in carbenes), as well as trivalency when due to carbon being either radicalic (as in triphenyl-methyl) or charged (as in carbocations and –anions). Rather, we focus on molecules where an uncharged trivalent carbon is surrounded by a complete outer shell of electrons, thus complying with the octet rule. To give students an account of these structures according to the valence-bond theory, carbon has not to be regarded as having promoted an electron from the 2s to a 2p empty orbital (which is its usual behaviour), but as having retained its 2s22p2 ground state, where a free electron pair is present, as well as an empty p orbital, which allows carbon to act as a lone-pair acceptor in a dative bond. Therefore, one of the three bonds to which trivalent carbon participates can be represented as dative (fig. 1), where D means donor. Most often, the carbon partner in the other two, non-dative, bonds is the donor itself, so that the carbon-donor bond is triple, carbon being sp-hybrid and placed at the end of an atom chain. This occurs, e. g., in carbon monoxide, probably the best known of trivalent-carbon molecules. According to the valence-bond theory, it could be represented as in fig. 2.

Here is a list of complete-shell molecules featuring uncharged trivalent sp-hybrid carbon; most frequently, the donor is a nitrogen atom:

a) CO ; CS (carbon monosulfide);

b) RNC (isonitriles or isocyanides); HNC (isohydrocyanic acid); HPC (isomethinophosphide or isophosphaethyne);

c) RONC (isofulminates); HONC (isofulminic acid); their thio counterparts RSNC and HSNC (please note that fulminic acid is HCNO and not HONC [1]);

d) NCNC (isocyanogen); CNNC (di-isocyanogen);

e) H2NNC (isodiazomethane) ; RR'NNC (isocyanamines) ; RR'C=NNC (N-isocyanimines).

In the above list, only CO and isonitriles are stable in contact with the atmosphere, under terrestrial conditions (isonitrile group is even present in some natural products! [2]). The other ones rapidly react or rearrange or decompose; often, they were first detected in the interstellar space.

More difficult is finding molecules where uncharged non-radicalic trivalent carbon is sp3- or sp2-hybrid; at best, some of these can be regarded as limiting structures that contribute to the corresponding resonance hybrids. So, an sp2-hybrid trivalent carbon could be proposed for one of the resonance structures of diazomethane (fig. 3) [3], where the free electron pair occupies the non-hybrid p-orbital, and a lone-pair of N2 "harpoons" the CH2 moiety of the molecule. As for similar structures with sp3-hybrid carbon, we failed in finding any example.

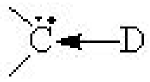

Fig.1

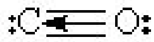

Fig.2

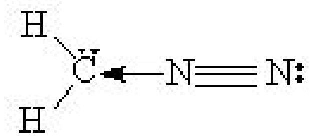

Fig.3

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T2P03

STUDENTS' DIFFICULTY IN CONNECTING THE PROPERTIES OF THE COMPOUNDS WITH CHEMICAL BONDING; MISCONCEPTIONS OF GREEK STUDENTS

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The aim of this project was to identify whether Greek students can explain the properties of some substances or compounds they use in their every day life, based on the kinds of chemical bonding. Another basic goal was to investigate students' misconceptions about chemical bonding in relation to the teaching methods and the curriculum.
The sample that was selected was composed of 142 students who had just entered the university with excellent marks in chemistry entrance examination. A questionnaire with seven cognitive content questions with was the instrument for the research.
The results demonstrated that students have difficulty in connecting the microcosm with the macrocosm and in realizing the relation between the properties of a chemical compound or a material and the types of chemical bonding that appear in it.
Also, many misconceptions about the chemical bonding were observed. Some of the students' alternative ideas are: The sugar is dissolved in water, so is an ionic compound; since M_r of SiO_2 is bigger than M_r of CO_2, SiO_2 is a solid while CO_2 is a gas; very powerful forces are appeared between the iodine atoms, so iodine is a solid. These forces between chloride atoms are very weak, so chloride is a gas. Moreover the students connected the existence of the covalent bond in CO_2 with the gas state and they connected the solid state with the ionic bond, thus the solid SiO_2 is an ionic compound. Generally, there is confusion between intermolecular and intramolecular forces as well as the kind of the intermolecular bonding.
All the above misconceptions that were compared with those from the literature [1-10] may be caused due to several reasons. One of them is probably the inappropriate teaching method that it was not based in the constructivism and the inquiry learning. Also, especially in Greece, there are many problems that students and teachers should come up with. For example, a large part of the teaching hour is spent to mathematic calculations in chemical exercises. The small number of teaching hours for the chemistry course, especially in the lower grades of high school, is a serious issue too.

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T2P04

THE AIM, IMPORTANCE AND METHODS OF ASYMMETRIC SYNTHESIS

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Some fields of science have shown the motivation to move from theory to practice as the study of asymmetric synthesis. An observation which the phrase 'asymmetric synthesis' was alone a mechanistic curiosity in 1965 along with no seriously confidence about converting that to an important part of molecular synthesis in future but in spite of this consideration its progression rate was completely considerable. During the time more than thirty years the organic chemist has converted this mysterious aspect of synthesis into the main part apparently for each class of chiral organic compounds in more than 90% enantiomeric purity. Today there is still processed significant growth in its way. Furthermore our conception from many instruction principles make it necessary to introduce that for students to a special level just after initial acquaintance to traditional organic chemistry.
Whearse there are many high level monographs and reviews covering special subjects, some of them would be utilized in researches, and don't consider overally suitable as definitive text for students new to this area. It is hoped it can prove useful as an introduction for progressive undergraduate and postgraduate students in Iran and other places, moreover for industrial chemists who are not acquainted with the field.
The origin of this argument is from five lecture courses on asymmetric synthesis presented to the final year B.Sc. and postgraduate students (MSc. and PhD.) at the *University of Sistan & Baluchestan*, Iran since 2000.
It makes a new motivation to students in organic chemistry and will be the way for them to investigate more advanced texts and literature to enhance their knowledge from one of the most important fields of modern chemistry.

T2P05

RELATIONSHIP BETWEEN STUDENTS' KNOWLEDGE STRUCTURE AND PROBLEM SOLVING STRATEGY IN STOICHIOMETRY

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Many papers in chemistry education research deal with the students' strategies, success and cognitive variables in stochiometric problem solving (e.g. [1-3]). Our research focuses on the questions: (i) How the Hungarian secondary school students solve stoichiometric problems? (ii) Are there any differences in characteristic knowledge structure between the student groups using different problem solving methods?
We used a written test containing one complex stoichiometric problem ('How many grams of hydrochloric acid (M = 36.5 g/mol) gives 10.0 dm^3 of carbon dioxide at STP (V_m = 24.5 dm^3/mol) according to the following chemical equation? $Na_2CO_3 + 2HCl = 2NaCl + CO_2 + H_2O$') and four simple problems (regarding molar volume, molar mass, chemical equation and proportionality) similar to the steps of two strategies (mole method and proportionality method) for solving the complex problem. The study involved 1072 students (grades 7-10) from 42 Hungarian schools. Based on the strategy used in solving the complex stoichiometric problem students were divided into three groups: (1) mole method group; (2) proportionality method group; and (3) others (unindentified strategy or no strategy). The knowledge structure characteristic of each group was determined by using knowledge space theory [4, 5].
The main results can be summarised as follows:
Only ca. 40% of the Hungarian students used any strategy in solving the complex stoichiometric problem. There was no significant difference between the success (ca. 70%) of the student group applying any strategy (group 1 and 2), but the achievement of the student group not using any strategy (group 3) was significantly lower (ca. 20%).
There was significant difference between the knowledge structure of the three student groups. The knowledge structure of student group 3 is very similar to the experts' knowledge structure, where the knowledge necessary to solving the complex problem is built on the knowledge regarding the molar mass, molar volume, chemical equation and proportionality. However, the knowledge structure of the student groups using any strategy shows that students typically used these strategies as algorithms instead of the conceptual understanding. For example in case of group 2 (the proportionality method group) the knowledge necessary to solve the complex problem is built on only one simple knowledge, the proportionality. Note that in the characteristic knowledge structure of group 1 (mole method group) the knowledge necessary to solve the complex problem is built on both the proportionality and the molar mass.

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T2P06

EXPLORING STUDENT'S CONCEPTIONS ABOUT LIMITING REAGENTS AND THEIR ABILITIES TO REALIZING &DETERMINING LIMITING REAGENT

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Learning is an active process, and what students do with facts and ideas with which they have been presented depends to a very high degree on what they already think and believe. Being able to recognize and work with these student-held ideas and conceptions is thus a key component of an effective educational strategy. According to teachers and educational researchers, there are some key misconceptions surrounding the chemical concepts. Researches indicate that student's misconceptions in learning chemistry arise from several resources [1], [2]. One of these resources is chemistry textbooks [3].
In this case, we investigated student's conceptions (that were traditionally taught) about concept of limiting reagent and their abilities to realizing & determining limiting reagent. In this study, we gave 15 conceptual questions in two steps to 60 students (11th grade) that explored their ideas and abilities about these concepts, 8 question given first and demand students to explain their answers and through this their ideas extract. 10 students also were interviewed for this propose .In second step, we gave 7 questions that demand student problem solving. These problems applied to extract their abilities to realizing & determining limiting reagent. Students were in two classrooms, and were taught by two different teachers.
Interesting outcomes achieved. We find that about 32% of student in this study attribute the concept of limiting to its social meaning and thought that limiting reagent are impediment in chemical reactions and they don't let chemical reactions go properly and fully. When we investigate source of this misconceptions, we found that pictures and contents of textbook about this concept are one of the main source for this misconception.

Students performance in second step indicate that these students can realize limiting reagent when the amount of reactants are given but when asked them to determine one special reactant as a limiting reagent, that is more practical and has more usage in industry, they confront with problem. When we investigate the sources of this problem, we found that existence of algorithm in this case and in other conceptual areas lead students to carry out computation with out meaningful learning [4].
In the end of this study, we suggested activities that seem to be useful in prompting student to learn conceptually. This new approach still is under study and its outcome will be announced later.

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T2P07

REFLECTING STUDENTS' UNDERSTANDING LEVELS ON CHEMICAL KINETICS CONCEPTS

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In the past decades, many works based on researchs students' understanding chemistry concepts have been done in science education. Up to now, in this context many chemistry subjects were examined. But very little study is avaliable understanding of chemical kinetics concepts. The present study aimed to reflect students' problems or disabilities on chemical kinetics concepts. With this aim, a two tier test consisted of 12 items on reaction rate and factors effecting reaction rate vas eveluated. In first part of questions there are misconceptions taken from literature and in second part students were asked reasons of their answer in first part. The test was carried out with 31 high school students who have been taught chemical kinetics concepts. The analysis of data reveal that students have some misconceptions and problems understanding chemical kinetics concepts. Some students think a catalyst be able to catalys all reactions or a very fast reaction can not be faster. Additionally students have problems about temperature effect on reaction rate in exotermic and endotermic reactions. Findings pointed out that students' problems on chemical kinetics concepts expecially focused on collision theory and how a chemical reaction occured. Findings indicated that since students couldn't imagine a chemical reaction and so collision theory they can't make correct explanations. This study provide a backdrop for further research on chemical kinetics.

T2P08

INTRODUCING AN INNOVATIVE NEW WAY FOR LEWIS MOLECULAR STRUCTURE EDUCATION BASED ON ICT

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The constructive understanding of learning science has gained a broad acceptance. One of the most important problems in teaching high school chemistry is that students can not connect the molecular, macroscopic and symbolic levels of chemistry. Since laboratory facilities are very limited in the third world countries and since the educational concepts presented to students are simply theoretical, in these countries integrating students with lessons in a lively manner is almost impossible.
To make an effective and student centered working process and gaining ideal results from modern education technology, applying professional software play an effective role in learning facilitation.
In this study that has been conducted on the base of effective educational experience in classrooms, firstly the nonbonding electrons of the central atom are calculated and then they place on the central atom, then the related concepts to Lewis structure are presented in an interesting and simple way in accordance with Octet rule. These concepts come in user-friendly software resulting in emerging a dynamic educational process. Using this software, teachers can give feedback to their students and assess them frequently in a pleasing way.
The above mentioned method is completely innovative and integrating it with ICT, can surely change and improve the educational process.

ŞEKİL EKSİK
Figure1. Lewis Molecular Structure Applied in the Produce Software.

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T2P09

IDENTIFICATION OF ALTERNATIVE CONCEPTION OF UNIVERSITY STUDENTS ON MATTER PHASE

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The identification of student levels in the field of science intended for scientific event, phenomenon, and concepts plays an important role in regard to the increase in students' success. It has been determined that the expected outcomes of students in the field of science do not always result in a significant learning. The topic of "matter" within these studies extends from the present syllabus of science and technology in primary education to secondary and university education [1]. A lot of studies have been done comprising students' opinions on the matter and the phases of matter. In these studies it has been found that students have a lot of wrong understanding or alternative conception in regard to the formation of the matter [1, 2]. This study has been conducted at Mustafa Kemal University, Faculty of Education, Primary Education Department with 270 1st year students. Students' alternative conceptions on the matter phase have been determined. In order to determine the alternative conceptions, open-ended questions have been used. Some of the alternative conceptions that have been obtained as a result of the data analysis are; hard matters are solid, solid matters do not take the shape of the container they are put in, if solids are put into a container they cannot be transformed, although solids have volume liquids and gases don't, the size (dimension) of the granules of solids are bigger than the granules of liquids and the granules of liquids are bigger than the ones of gases, solids have more granules than liquids and liquids have more granules than gases, matters that can be poured from one container to the other are liquids , gases evaporate, gases do not have weight, since gases are not affected by gravity they do not fall down like the solids and liquids.
Lack of information and alternative conception are an important problem for both students and teachers in the teaching of science. Students when attending their first science courses come to class with prejudices which are scientifically regarded as incoherent and false beliefs. Causing students to learn science literacy, which is necessary in every phase of life, can only be able by educating teachers who are equipped with the right information and who are purified from alternative conceptions [3].

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T2P10

A COMPARISON OF CONTEXT-BASED AND PROBLEM-BASED LEARNING

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It has been reported that Context-based approaches in which contexts and applications of science are used as the starting point for the development of scientific ideas [1]. However, Millar reported the idea that science teaching may start from applications and contexts has onlyreally come back into prominence since the 1970s [2]. Thus, the first systematic attempts to produce context-led teaching materials for secondary school science were Aikenhead and Fleming's Science: A way of knowing developed for use in schools in Saskatchewan in Canada [2].
Problem-based learning (PBL) is an active learning method based on the use of ill-structured problems as a stimulus for learning [3, 4]. Problem-based learning was initially designed for graduate medical school programs. The reason behind this was that young physicians were graduating with plenitude of information but without the critical reasoning skills to use that information wisely [5].Nevertheless, PBL has alsobeenadaptedforuse in elementaryandhigh schools [6].
Problem-based learning can be considered to be a subcategory of context based approach. In PBL, like context-based approach, instruction design is organized and driven by real life contexts and these contexts are presented in the form of problem scenarios. An important feature of PBL is that the problems or scenarios are encountered before all the relevant learning has taken place and act as the driver for new learning [7].
However, problem based learning method can be used in the instruction design of context based approach in which contexts and applications of science are used as the starting point for the development of scientific ideas. Therefore, from this point of view, both of them may be considered as similar. Besides, context based approach can be used together with other active learning methods.
The purpose of this study was to investigate the relationship between context based approach adopted in science curriculum design and problem- based learning used in science teaching.

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T2P11

A PITFALL IN INDIRECT ANALYSIS CALCULATIONS

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A typical "indirect analysis" problem proposed to the students who begin to deal with chemistry calculations could be the following:
"By combustion, a known mass *m* of a mixture of two organic compounds *A* and *B*, whose molecular formulae (and hence molar masses M_A and M_B) are known, produces a known volume *V* of CO_2, at known pressure *P* and temperature *T*. Find the mass of each component of the mixture."
Solving the problem would seem everyday routine to each of us. Yet, there are cases for which no univocal solution can be found. This occurs when the two components of the mixture have the same elemental composition, but different molecular formula, as it the case of such couples as, e. g., benzene and ethyne (or acetylene), cyclohexane and butene, ribose and lactic acid, adenine and hydrocyanic acid, and so on. Needless to say, it occurs all the more when the components of the mixture are a couple of isomers.
To work out a practical example, let the mixture be made, e. g., of benzene C_6H_6 (M_{C6H6}= 78 g/mol) and ethyne C_2H_2 (M_{C2H2}= 26 g/mol), have a mass of 100 g, and produce 185 L of CO_2 (measured at 20 °C and 1.00 atm), which means 7.69 moles of CO_2 .
After designating as *x* and *y* the amounts (number of moles) of C_6H_6 and C_2H_2 , respectively, the following system could be set up:

$$\begin{cases} M_{C_6H_6} \cdot x + M_{C_2H_2} \cdot y = 100 \\ 6x + 2y = 7.69 \end{cases}$$

Figure 1

But the molar mass of benzene is exactly three times that of ethyne, so that the system can be first rewritten as

$$\begin{cases} 3\, M_{C_2H_2} \cdot x + M_{C_2H_2} \cdot y = 100 \\ 6x + 2y = 7.69 \end{cases}$$

Figure 2

and then as
The two equations of the system, instead of being independent of each other, are identical, which means an infinite number of couples of *x* and *y* values can satisfy them.
It is to be remarked that the problem would admit a univocal solution, if it could be re-formulated as follows:
"At suitable temperature *T* and pressure *P*, a gaseous mixture of two organic compounds *A* and *B*, whose molecular formulae (and hence molar masses M_A and M_B) are known, occupies a known volume *V*. By combustion, it produces a known volume *V'* of CO_2, at known pressure *P'* and temperature *T'*. Find the mass of each component of the mixture."
Actually, with reference to the previous example, in this case the equations of the corresponding system

$$\begin{cases} x + y = PV / RT \\ 6x + 2y = P'V' / RT' \end{cases}$$

Figure 3

would be independent of each other. Once *x* and *y* are known, the mass of each component can be immediately found.

A COMPARATIVE APPLICATION OF DIFFERENT LEARNING PROCESS FOR REMOVING OF MISCONCEPTIONS ABOUT CHEMICAL BONDING

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In recent years there has been a considerable amount of research activity into student conceptions in a variety of areas of science (1, 2, 3). Chemical bonding is a key concept area for students of a level chemistry, and one which has not received as much attention as its importance might suggest (4, 5). It is a topic which can be taught, and understood, at a variety of levels of sophistication (4, 5, 6).
The aim of this study was to reveal misconceptions by the candidate teachers in the department of chemistry and science education students about chemical bonding concepts and was to compare the effects of computer supported collaborative learning (CSCL) and computer supported individualistic learning (CSIL) on the students' understanding of this topic. To determine students' misconceptions concerning chemical bonding, the Chemical Bonding Concept Test (CBCT) consisting of 24 multiple-choice questions was used as a pre-test and some students were interviewed. According to the results, fourteen misconceptions about chemical bonding were identified. The classrooms were randomly assigned to a control group (computer supported individualistic learning (CSIL), 15 chemistry, 45 science education students) and an experimental group (computer supported collaborative learning (CSCL), 13 chemistry, 41 science education students). After instruction, the same test was administered to both groups as a post-test. The results of CBCT were evaluated according to related literature. The effect of the teaching approaches and other variables on the students' CBCT post-test scores was determined.

Key Words: Chemistry education, chemical bonding, removing of misconceptions, computer supported collaborative learning, computer supported individualistic learning.

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T2P13

WORKSHEETS TOWARD VISUAL ARTS ACTIVITIES ADAPTED BY OBJECTS ABOUT PARTICULATE NATURE OF MATTER IN CHEMISTRY TOPICS OF SCIENCE AND TECHNOLOGY COURSE

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In this study, worksheets toward visual arts activities were prepared in accordance with the objects about particulate nature of matter in science and technology course. The visual arts activities in worksheets are, in turn, the marbling art, the pyrography, the photography and the metal etching art. Worksheets were planned according to the cognitive learning and social learning of constructivist learning approach. These worksheets contain parts toward the activity called 'title', 'student objects','instruments and materials', 'safety' and 'process'. The title of the activity was written as an interesting question form to rise students' awareness. So, the titles of visual art activities are, in turn, 'how do dyes or pigments float on water?' for the marbling art, 'how can we draw without a pencil or paint?' for pyrography, 'how does an image occur on photography?' for the photography and 'can we draw with diluted acids on metal plaque?' for metal etching art. Objects of activity for students were related to (1) topics, (2) scientific process skills, (3) attitudes toward science-technology-society-environment and (4) emotional attitudes to particulate nature of matter. Instruments and materials for the activity were written with the following objects. Safety explains hazards and risks in the process of the activity. The process of the activity consists of stages such as questions, experiments, demonstrations, predictions, observations, results, comments, explanations and generalizations toward the activity. These follow the regular hierarchic diagram. A few-line space was given to students' so that they could write their opinions about these stages while doing the activity. These stages are very important parts. If there is no hierarchic diagram of the stages, students can not be interested in these objects. Students can learn these objects with visual art activities. Worksheets should be given to all students and be applicated with cooperative studies to student's groups for social learning. The tutor has to follow both cooperative artworks of groups and students' worksheets. If worksheets are absolutely completed at the appropriate time, students will both save time and discover the activity easily. Students generally do not want to answer questions on worksheets, instead of this, they only want to observe or test stages related to the activity. All of them should be done on the worksheets.

T2P14

NBO SOFTWARE; A POWERFUL TOOL IN CHEMICAL EDUCATION

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Quantum chemistry software's have a profound impact on teaching chemistry in the resent years. Teachable explanation for general audiences, quantitative accuracy, prediction of chemical reactivity and interpretation of spectroscopic data are some of the most important aspects of this software's. One of the most important software which can simultaneously use by general and advance audience is the natural bond orbital (NBO) [1,2]. The natural charges, Lewis diagrams, bond types, hybrid descriptor, bond orders, charge transfer, NMR descriptor and resonance weights are some of the basic chemistry concepts which appears in the NBO software out put. Furthermore, these concepts clearly visualize or graphical represent with NBO View complementary software and helps the student and researchers to explain the results. For example, from the charge transfer and bond orders in resonance assisted hydrogen bond systems (RAHB), one can evaluated the hydrogen bond and p-electron delocalization energies [3,4].

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T2P15

FACTORS THAT INFLUENCE STUDENTS' PERFORMANCE ON SCIENCE IN A CROSS – CULTURAL CONTEXT

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The purpose of this study is to identify the influence of the relevant distinctive "inputs" and "outputs", as they are shaped through the educational and learning processes taking place both at school and classroom level in a broader socioeconomic and cultural context. [1-3] Inputs include all factors concerning financial resources and elements in the structures of educational systems. These factors describe the dynamics of educational systems, that is, the primary characteristics leading to the best possible performance. Outputs include students' performance; achieving the aims of the educational system; and the extent to which the labor market is covered. [4]
In terms of outputs, the research has focused on the performance of students in Science according to the Program for International Student Assessment, PISA 2003. Concerning inputs, it focused on gathering valid and reliable sources of economical and educational data from international organizations, such as UNESCO, WORLD BANK, CIA and OECD. Overall, the variables gathered were 105 according to Orrivel's framework analysis for all 41 countries participated in PISA. [5]
In order to reduce the large number of variables, the methods of factor analysis and regression were used to evaluate 14 blending factors containing the information of the variables. [6] Then, using the method of multiple regression, the factors relating to the performances of countries on Science according to PISA were defined. The use of stepwise multiple regression resulted in a statistically significant model that interprets the 70.7% of the variance of the countries' ratings on Science in PISA (Adjusted $R^2 = 0.707$ – df [4, 21], $F = 16.08$, $p < 0.001$). The defined factors are:

Factors	**Percentage of the Variance (%)**	**F**	**p**
Affluence	52	28.11	<0.001
Enrolment ratio in tertiary	8	5.87	<0.05
Educational expenditure	8	6.60	<0.05
Expenditure in tertiary	6	5.66	<0.05

The results indicate that the highest percentage of the variance is interpreted by the factor "affluence", thus the method was repeated without this particular factor. This resulted in a statistically significant model that interprets the 70.7% of the variance (Adjusted $R^2 = 0.707$ – df [4, 21], $F = 16.08$, $p < 0.001$). The arisen factors are:

Factors	**Percentage of the Variance (%)**	**F**	**p**
Enrolment ratio in tertiary	40	17,29	<0,001
Enrolment ratio in secondary	17	10,64	<0,05
Shortages in building infrastructure	8	6,25	<0,05

Teaching hours per year	6	5,41	<0,05

As a conclusion, we can say that among the inputs of an educational system the affluence and enrolment in tertiary education interpret a large percentage of the variance of students' performances on Science according to PISA. However, we must not diminish the contribution of educational processes and in general the total amount of work done in classroom. These parameters can overcome the negative impact that certain inputs might have on outputs of an educational system.

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T2P16

A WORKSHOP ON SCIENCE EDUCATION

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In this research an issue of a two years experience achieved by a established station for research and education is demonstrated. In this station the students of different schools was presented and became acquainted with scientific concepts by applying computer design and modeling. The students' questions and ideas in physics chemistry and mathematics had been studied by using computer modeling. Also in this station the students became encouraged in learning scientific concepts by observing exciting experiments. Using networks, the education had been continued all the times in different places. Different teachers learned the method of education by the corresponding modeling in their lessons. This method is an efficient and inexpensive way which can be applied for schools standardization in different countries. Also this method is helpful in publicizing science education

T2P17

DEVELOPMENT AND APPLICATION TWO-TIER DIAGNOSTIC TEST ABOUT CHEMICAL BONDING FOR UNIVERSITY STUDENTS

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One of the most important branches in science education is chemistry. It is a difficult branch for young students because its topics are very abstract [1]. Some terms in chemistry are used in everyday language with different meanings [2]. Students' misconceptions play a significant role in their learning of new scientific knowledge [3]. Therefore, the identification and remedy of their misconceptions are of great importance.
Researches have shown that students have a lot of misconceptions about chemical bonding. This topic includes different models from simple analogical models to sophisticated abstract models.[4].The chemical bonding unit is instructed 9th-11th grades chemistry curriculum in Turkey. The students of the 9th-11th grades have difficulty in connecting between chemical bonding units of these grades. Chemical bonding is also an important topic for undergraduate chemistry because it is the key to molecular structure [3].
In this study, 5 open-ended questions were asked to determine misconceptions before instruction of chemical bonding. A two-tier diagnostic test was developed to determine misconceptions with a comprehensive literature survey and according to results of 5 open-ended questions [5]. The test was applied to the physics and chemistry education students of Dokuz Eylul University in Izmir. Reliability of this test was found 0,705. Computer assisted material including animation and analogy was used to remedy from misconceptions. The material was applied to the students by the same teacher. It was prepared for university students to clarify their chemical bonding knowledge 9th-11th grades and to discover their misconceptions. It included such subjects as atomic and ionic radius, electronegativity, electron affinity, covalent bonding, ionic bonding, metallic bonding, hydrogen bonding, coordinate bonding, van der walls forces, bond polarity, polarity of molecules, formal charge, transition between ionic and covalent bonding. The relation between physical characteristics of molecules based on chemical bonding was put into test. Frequency analysis was made through the use of SPSS 11 and it was observed that misconceptions were recovery at positive direction. The data was analysed with SPSS 11. The test analysis was realized to determine significance of the mean values of students understanding levels.

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T2P18

DEVELOPMENT AND APPLICATION OF A DIAGNOSTIC CONCEPT TEST TOWARDS "MOLECULAR GEOMETRY"

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Molecular geometry is one of the microscopic dimensions of chemistry. This unit includes such issues, resonance, octet rule, Lewis dot structures, VSEPR, molecular orbital theory and these are closely related to chemical bonding. In many issues, it is determined that chemistry is a complicated science for students and they have difficulty in understanding the chemistry concepts [1-5].

In this study, a diagnostic concept test comprising 30 questions was prepared as a two-tier test [6], after a comprehensive literature study about molecular geometry. Its reliability (KR-20) was determined 0,729. The questions were prepared that they diagnosed alternative conceptions of the students on this unit. At first, the prepared test was applied as a pretest to the undergraduate student groups (n=60) chosen from the departments of Physics and Chemistry Education of Dokuz Eylül University in İzmir. Then, towards their misconceptions, defined in the literature, [4-5] a computer assisted material was prepared, including some analogies and demonstrations regarding "Molecular geometry" (for example, balloon clusters, ball-and-stick models, dancers, etc. [7]). This material was applied both of the groups by the same teacher. After the application, the concept test was applied to the students again as a post test because of detecting differences in learning outcomes between two points in time. To analyze data SPSS 11.0 statistics program was used and the significance of the mean values of students' understanding levels was determined by means of t test analysis. Thanks to this study, in teaching this unit, using some analogies, demonstrations or computer assisted methods and giving examples from daily life got increased the understanding of this unit easy. And a remedy was found out in the misconceptions of the students.

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T2P19

AN INVESTIGATION INTO THE EFFECTIVENESS OF CONCEPT MAP-BASED LEARNING IN A CHEMISTRY COURSE

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The aim of this study was to investigate the effectiveness of concept map-based learning (CMB) approach in a chemistry course. This research has been done in Ghom town, Iran. This research designed a new creative teaching method for the atomic structure mental concepts at the second high school chemistry course which was based on concept map. The concept map usage effects on developing of meaningful learning were studied. The design of this study was four groups pre-test–post-test (Salomon's design). The results suggest that the CMB approach promoted high levels of bloom's taxonomy in the learning process including analysis, synthesis, and evaluation. In other word our results showed the meaningful learning frontier is taken place from the application level above in the bloom's taxonomy. The output of data analysis shows there was meaningful difference between the scores of experiment and control groups of students with using concept maps by the students. This object was observed between the score of boys and girls groups, too. Our results and others in this area were indicated active and affective teaching-learning's condition process, so that it leads us to attempt in order to develop this approach in a large scale in educational system of our country.

THE RESPONSIBILITIES OF TEACHERS IN LABORATORY SAFETY PROGRAMS

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In chemistry laboratories at educational institutions, it is very important to provide safety in order to prevent or minimize hazards. Although the importance of laboratory safety has been known for many years in industry, some educational institutions have been lacking in practising such safety programs. Data from industry studies indicate that occupational injury rate is highest at the beginning period of employment due to inexperience. Similarly, in a high school laboratory setting where students experience new activities, the probability of incidents, injury, and damage is high. Therefore, it is significant that the students are taught what is wrong, how to prevent such events and what to do in case of an emergency.
Teachers play the most important role in insuring laboratory safety and healthful learning environment for the students. First, teachers should set the students an example, therefore they should follow and obey safety rules, and demonstrate safety behavior and promote a culture of safety. And then, they should observe, supervise and instruct the basic safety practices and basic principles of health hazards to the students during the experimentation.
The aim of this study is to deal with an important of laboratory safety programs in educational institutions, responsibilities of teachers in laboratory safety programs and then to give general safety information about ordering, using and storing chemicals; chemical waste, safety and emergency equipment; common safety symbols, signs and basic documentations such as Material Safety Data Sheets, Chemical Hygiene Plans and Check Lists; and assessing chemical hazards.

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T2P21

PROMOTING THE CHEMISTRY EDUCATION WITH VISUAL PRESENTATION EQUIPMENT IN EDUCATIONAL INSTITUTIONS

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In general, students sound off due to hardness of understanding chemistry at middle school or at high school. They do not prefer to be interested in chemistry. This results from inactive learning processes. In order to motivate or arouse interest of students to chemistry, some teachers make them do experiments with kinds of coloured compounds, reactions producing mystic smoke or steam, water or fire fountains, or spectacular light etc. Demonstrations of chemical experiments with observable changes such as a change of color, solubility, or change in electric conductivity commonly arouse the interest and the curiosity of students.
Therefore, visual presentation equipments are significant part of active learning processes. Visual tools help in the progress of understanding the basic science of chemistry and permanent learning. Visual presentation equipments such as graphical presentations; computer presentations (video animations, 3D simulations of molecular structures, etc.); online learning contents (web sites, experiments, texts, graphics, movies, games, easily a table of contents and/or buttons, assesments) stimulate learning and provide valid and permanent perceptions and learning chemistry of students. And also, these presentations make learning science a fun experience.
Integrating these visual presentations into the chemistry curriculum with other traditional teaching methods in educational institutions will promote the arouse interest of students to chemistry and increase their effectiveness in learning process.Besides students can practice safe and reproducible way of doing experiments.
Therefore, creating a curriculum-based Internet sites for chemistry; using web sites related to the chemistry curriculum in the classrooms; and working to integrate web-based learning into chemistry studies are of capital importance in order to generalize active/constructive learning processes in educational institutions.
The aim of this study is to explain the significance of visual presentation equipments in chemistry learning processes with examples and to suggest promoting the chemistry education with visual presentation equipments in educational institutions.

T2P22

THE DIFFICULTIES OF ALGORITHM PROBLEM SOLUTIONS IN THE CHEMISTRY LESSONS

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The chemistry lessons consist of the experiment and observation. So it is essential that mathematical expression should be used with result of the experiments and observations in the chemistry lessons. Thus it is important that student use mathematics knowledge in the chemistry lessons. There are a lot of formula and calculating methods to use with special issue in the chemistry. Mainly chemical works contain literature explore, experiment, observation, mathematical calculations, and interpreting of results. If mathematical expressions are used exactly, the results of the work will be influenced in the different chemical issues .
The priority of the education is to teach the individuals to cope with the problems which they would encounter in the future. It is believed that to bring in the students this kind of a talent, problem solving should be the center of the education [1,2]. Harren defines the problem solving as a process of coping with a definite or real handicap and reaching a target [3]. He had formed the problem solving model by dividing into four steps as, understanding the problem, defining the problem, organizing a plan and verificatin. According to Morgan, problem is a conflict which hinders the individual who is trying to reach a target [4].
In the chemistry lessons, the methods that the students use for problem solving, cover the mathematics knowledge and capability besides the chemistry know how. In order to make some calculations, to do some mathematical transactions and especially to find the data which should be calculated by complex formulations, it is necessary to do some mathematical transactions inside the formulation.
The purpose of this study is to determine the difficulties of algorithm problem solutions in the chemistry lessons. The survey form was prepared in line with the research's aim. The sample of this study consists of preservice teachers at Istanbul University, Faculty of Hasan Ali Yücel Education, Departmant of Elementary Education, Division of Elementary Science Education. For the analysis of the data, SPSS 13.0 program was used. Ki-Kare (Chi-square) test was applied, in order to determine if there is a difference between the questions according to sociodemographic variables. In line with the results of the survey, necessary recommendations were given.

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T2P23

SCORING GENERAL CHEMISTRY CONCEPT MAPS: SOME PRELIMINARY RESULTS

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Because our students have many interests besides to study chemistry, it is more and more difficult to engage them in deep and meaningful learning. To help students organize and structure their knowledge, and to engage them in learning, they are asked to draw concept maps [1] for every topic presented in the course syllabus. In the very first lesson concept maps are presented with instructions for drawing them and expectations that all students will learn and many will learn a lot were voiced. Students are advised to draw the maps according to their learning styles, and some maps can be considered abstracts or crib sheets.

These artifacts freely produced by the individuals are natural protocols of their efforts in making sense of the concepts. Concept maps are interpreted as representative of students' knowledge structures; might they provide one possible mean of tapping into a student's conceptual knowledge structure? Can they be assessed in a reliable way?

Many studies using distinct concept mapping scoring systems claim the utility of such methods in assessing declarative and procedural knowledge [2-4]. Different types of assessment explore different domains of student knowledge. So some caution might be advised in the use of this alternative assessment [5].

We analized for assessment 80 maps (each drew from 4 to 12 maps) of the 10 best students and 81 maps (each drew from 2 to 28 maps) of the 10 weakest students. This classification is made according to the marks they got to the oral final exam. We counted the number of concepts, cross links, nouns and verbs, the formulas, the examples, the data, definitions, drawing and schemata, and the errors. Students' different attitudes, their learning styles, logical reasoning ability, and motivation were also considered.

The claim that students using concept maps for their study and revision would perform better on their assessment tasks, than those who did not, is weakly supported. The best students reported in their maps from 18.0 to 86.3% of the concepts taught in the course; the weakest students from 4.4 to 72.2%. From our data, the hypothesis that students with 'good' maps would do better than those with 'poor' maps was not supported. Our limited data show that the scores from concept maps must be managed with prudence since their use as a measure of the real learning of science is still not certain [6].

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T2P24

THE EFFECTS OF USING LOW COST MATERIAL FOR MOLECULAR MODELING

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Molecular modeling is used to explain scientific concepts in chemistry courses [1, 2, and 3]. This study aimed at describing the results of an open-ended questionnaire given to 46 freshman students (27 males and 19 females) to gain some insights into the students' understanding of the molecular modeling role, its positive and negative sites, and its relation to the reality in the chemistry world. Using active learning approach, Lewis structure and VSPER theory were covered during the 2005-06 spring semester at a College of Education located at northeast part of Turkey. Each of molecular structures was prepared in a 50-minute chemistry class. The students stated that these activities provided a better understanding of the roles of the molecular models in chemistry lessons and interested in the learning of the chemical bonds. Students showed positive attitudes toward chemistry as an evidence of having creative skills. The usage of play dough for making molecular modeling would be a useful tool to contribute the students' learning about chemical bonds.

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T2P25

EXPERIMENTS WITH THE CANDLE - ALTERNATIVE CONCEPTS AND CHEMISTRY TEACHING

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In the course of learning chemistry, students develop various alternative concepts [1]. Development of such alternative concepts can exhibit far-reaching consequences on further chemical education. Consequently, in order to achieve a better quality in the teaching of chemistry, it is necessary to:
1. determine the types of pre-concepts that students have already developed prior to entering the elementary chemistry courses,
2. determine the types of alternative concepts that are developed by existing teaching strategies,
3. determine how and why alternative concepts are developed,
4. determine the relationship between student's higher cognitive skills and the ability to develop concepts.
A cross-age study was performed with the intention to determine the alternative concepts that were developed by students in explaining and describing observed chemical change through the concept of a chemical equation. The experiments used were the simple and well-known experiments with the candle. The results obtained were correlated with teaching strategies exploited by chemistry teachers in teaching the concept of the chemical equation.

Keywords: Experiments with the candle, Alternative concepts, Cross-age study

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FACTORS THAT INFLUENCE STUDENTS' PERFORMANCE ON SCIENCE IN A CROSS-CULTURAL CONTEXT

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The purpose of this study is to identify the influence of the relevant distinctive "inputs" and "outputs", as they are shaped through the educational and learning processes taking place both at school and classroom level in a broader socioeconomic and cultural context. [1-3] Inputs include all factors concerning financial resources and elements in the structures of educational systems. These factors describe the dynamics of educational systems, that is, the primary characteristics leading to the best possible performance. Outputs include students' performance; achieving the aims of the educational system; and the extent to which the labor market is covered. [4]

In terms of outputs, the research has focused on the performance of students in Science according to the Program for International Student Assessment, PISA 2003. Concerning inputs, it focused on gathering valid and reliable sources of economical and educational data from international organizations, such as UNESCO, WORLD BANK, CIA and OECD. Overall, the variables gathered were 105 according to Orrivel's framework analysis for all 41 countries participated in PISA. [5]

In order to reduce the large number of variables, the methods of factor analysis and regression were used to evaluate 14 blending factors containing the information of the variables. [6] Then, using the method of multiple regression, the factors relating to the performances of countries on Science according to PISA were defined. The use of stepwise multiple regression resulted in a statistically significant model that interprets the 70.7% of the variance of the countries' ratings on Science in PISA (Adjusted $R^2 = 0.707$ – df [4, 21], $F = 16.08$, $p < 0.001$). The defined factors are:

Factors	**Percentage of the Variance (%)**	**F**	**p**
Affluence	52	28.11	<0.001
Enrolment ratio in tertiary	8	5.87	<0.05
Educational expenditure	8	6.60	<0.05
Expenditure in tertiary	6	5.66	<0.05

The results indicate that the highest percentage of the variance is interpreted by the factor "affluence", thus the method was repeated without this particular factor. This resulted in a statistically significant model that interprets the 70.7% of the variance (Adjusted $R^2 = 0.707$ – df [4, 21], $F = 16.08$, $p < 0.001$). The arisen factors are:

Factors	**Percentage of the Variance (%)**	**F**	**p**
Enrolment ratio in tertiary	40	17,29	<0,001
Enrolment ratio in secondary	17	10,64	<0,05
Shortages in building infrastructure	8	6,25	<0,05
Teaching hours per year	6	5,41	<0,05

As a conclusion, we can say that among the inputs of an educational system the affluence and enrolment in tertiary education interpret a large percentage of the variance of students' performances on Science according to PISA. However, we must not diminish the contribution of educational processes and in general the total amount of work done in classroom. These parameters can overcome the negative impact that certain inputs might have on outputs of an educational system.

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T2P27

'HYDROXYL GROUP' (-OH) AND 'HYDROXIDE ION' (OH^-): TWO CHEMICAL SPECIES AND TERMS WITH PROBLEMATIC USAGE BY TEACHERS AND STUDENTS

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Considerable misunderstandings and errors are being made by teachers and students in school chemistry that have to do with the specific meaning of chemical symbolism and the understanding of definition of terms (***orismology***) (Saymour, 1998). This study aimed to diagnose whether students are acquainted with and comprehend: a number of chemical terms and symbols. In this paper, we pay attention to the chemical symbols and the orismology associated with the 'Hydroxyl Group' (-OH) and the 'Hydroxide Ion' (OH^-):

In current chemical nomenclature, the term **hydroxyl group** is used to describe the functional group –OH when it is a substituent in an organic compound; also the prefix 'hydroxy' shows the presence of a hydroxyl functional group (-OH). Note however that one or more hydroxyl groups appear also in the structures (strucuiral formulae) of the inorganic *oxo-acids*, eg. nitric acid, sulphuric acid, etc. Note also that the term 'hydroxyl radical' appears instead of 'hydroxyl group' in older usage.

In particular, it was attempted in this study to find out whether Greek students were acquainted with differences between the two species, and the fact that their imprecise use can lead to confusion. The research methodology used was an in-depth qualitative study that was built upon personal interviews conducted via a semi-structured questionnaire.

Eighteen freshman students (academic year 2004-2005) of the Department of Chemistry of Aristotle University of Thessaloniki participated in the study. The interviews were conducted at the beginning of the academic year, so that their answers reflected knowledge obtained from high school, not from university. In addition, the sample was selective in terms of having students with a special interest in chemistry, and above the average performance in the Greek university entrance examination.

In the interviews, the students were shown three cards, and after seeing each card the students were asked a number of relevant questions. Card No. 1 showed the compounds NaOH, KOH, and $Ca(OH)_2$. Card No. 2 showed the species –OH. Finally, Card No. 3 showed the species OH^-.

With regard to Card No. 1, the students knew the names of the three shown compounds, and almost all students (16/18) classified the three compounds as bases. Also all students knew that the presence of the species 'OH' was responsible for the categorisation as bases. Eleven (out of 16) students were aware of the existence of compounds that are categorised as bases without 'OH' to be present in their formula. A satisfactory number of students (13/17) knew that there exist compounds that contain in their structural formula the species 'OH' without being bases but acids.

With regard to Card No. 2, only four students were clear that the species shown was called 'hydroxyl' or 'hydroxy' group', while 10 students stated that it was still 'hydroxide'. Eleven (out of 18) students answered that 'hydroxyl' and 'hydroxide' were the same species, and only two that they are two different species. Similar were the findings with regard to Card No. 3.

In conclusion, we can state that the majority of the students of our sample recognised metal hydroxides and classified them as bases. On the other hand, it appears that many students had difficulty distinguishing between the hydroxyl group and the hydroxide ion. The majority of students were not familiar with the differences between these two entities and as a result they used the terms 'hydroxyl' and 'hydroxide' indistinguishably.
Suggestions for improved instruction on the topic of this study are made. The problem lies here not only with students but also with university instructors and high-school teachers who themselves often use the two terms indistinguishably. Also particular attention should be paid to dealing with the difficulties associated with understanding chemistry at the sub micro and symbolic levels (Gilbert and Treagust, 2008) at which the differences between the two species lie basically.
Keywords: High-school chemistry, orismology, hydroxyl group, hydroxide ion, bases, acids.

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T2P28

JUSTICE ABOVE ALL ELSE – ANALYTICAL CHEMISTRY IN A FORENSIC COSTUME

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Forensic chemistry is one of the most important subject for teaching students in the Laboratory for Forensic Chemistry at Jagiellonian University. Taking into consideration that the physical and chemical background of an analytical method is much more curious and fascinating when it is connected with realistic criminal situation, the Laboratory Team developed a laboratory class related to the questioned document examination and the chemical analysis of inks extracted from paper.
The mentioned class is titled The examination of inks from documents by capillary electrophoresis (CE) for forensic purpose and it consists of two parts – theoretical and practical. At the beginning of the first one, trainees (up to 6 students) present their knowledge connected to a subject by a single-handedly made Powerpoint presentation (prepared at home). What is worth to notice, among books and learning aids there is a popular science article which presents complicated CE problems as intelligible tale about travel to instrument inside. After presentations students are divided into two groups for a short competition. It gives the possibility to control students knowledge, enrich their memory, develop their ability to work in groups and cooperate with each other.
Working in the same group of six as for the theoretical problem, students are asked to play roles of laboratory forensic scientists. Common activities done during the laboratory class are more exciting and understandable for students who imagine being an expert with particular case to solve. At the beginning a questioned document – the trade agreement – is given to the students. First, they try to visually investigate it to discover any suspect text which could have been altered. Suddenly, after 5 minutes the writings starts to disappear. It is only a joke – invisible ink is used to increase interest of analyzed object. In order to observe actual document (i.e. written by usual ballpoint pen) students can use a magnifier glass and microscopes. However, like it often happens in the routine forensic document examination simple, nondestructive analytical methods do not give sufficient information to differentiate inks (writing tools). Thus, destructive chemical examination methods have to be used. Students practically use the instrument introduced in the theoretical part of the course, i.e. the capillary electrophoresis system and analyze inks sampled from the document. They are given an opportunity to work individually, taking samples, preparing solutions, doing the analysis so they have good opportunity to assimilate with the activities and working in the laboratory.
In order to improve teaching process the laboratory class is supported by several video-clips and computer animations. It is well known that the more senses are used to reject information the more of them is remembered [1]. The application intrigue students and encourage them to become independent learners. What is more, educational video-films explain some activities normally not done by students, e.g. changing a capillary.
After completion of whole analysis, the work is summarized by discussion. All students consider obtained results, interpret them and prepare together the conclusions. Results of analysis are gathered in an official laboratory report and in an expert opinion.

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T2P29

A FORENSIC LABORATORY CLASS - APPLICATION OF THE AFS METHOD TO POST-MORTEM EXAMINATION OF ACUTE TOXIC METAL POISONING

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The possibility for undergraduate students to study the forensic chemistry was firstly given in Poland at the Jagiellonian University in 2000 in Krakow. A new laboratory – Laboratory for Forensic Chemistry (LFCh) was established at Faculty of Chemistry. The interest of LFCh is focused on the development of new analytical methods for forensic purposes. However, the most important task of the LFCh is teaching experimental forensic chemistry.
The aim of this presentation is to show the forensic laboratory class connected with fatal poisoning. The class is titled Analysis of biological materials to determine selenium and arsenic by atomic fluorescence spectrometry with hydrogen generation and it consists of two parts – theoretical and practical. At the beginning students present their knowledge connected to a subject by a PowerPoint presentations made at home. Then the forensic expert makes a presentation with a photo-story explaining the cases of fatal poisoning (by selenium and arsenic) to introduce students to every step of the toxicological examination including the way how to write expert opinions. Moreover, he explains the chemical and physical background of atomic fluorescence spectrometry and digestion technique. In the practical part students prepare the material evidences (blood, urine in selenium in selenium poisoning case and hair, liver, brain in arsenic poisoning case) by using microwave digestion technique. All samples are then simultaneously examined by the atomic fluorescence spectrometry.
In this way, the class is very exciting and understandable for students who have a chance to imagine themselves to be forensic experts. Using such didactic techniques like: Problems of Base Learning and Learning in Contest are very useful. The presented form of laboratory class gives an opportunity for the students to work individually and in a group, to do interesting analysis and to interpret analytical results properly.

T2P30

USING SIMPLE EXPERIMENTS FOR TEACHING SCIENCE – CASE STUDY ELECTROSTATIC

N.Jafari, M.Behzadipour, A.Asfa and F.Ahmadi
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This research undertakes an study on achieving better understanding of the Concepts of the physical phenomena's by applying physical experiments. We specifically design simple experiments to explain the concept of the electric field and potential of the physics books of the high schools. The considered statistical society has been chosen randomly from two homogeneous groups of the female students from an high school of Tehran. One group has been experienced by experimental education and the other by the traditional education. Then a comparison is taken with independent T-test on the gained skill and enhancement of the students groups.

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T2P31

INTERACTIVE TEACHING MODELS EFFECTS ON LEARNING KINEMATIC CONCEPTS

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This research soughs to analyses the instruction effect of the kinematic concepts in two way of interactive and non interactive on the knowledge, attitude and skill of the female junior high school students. And purpose is selection of the appropriate instruction strategy.
The statistical society of this research is two homogeneous groups of the female junior high school students in Tehran which were selected at randomly simple way. One group is under the interactive instruction and the other group is under the non interactive instruction kinematic discourse. Then using the independent T test and variance Levens test that we consider to compare the effect of these two teaching way in increasing the knowledge, application skills on the knowledge and improving the attitude of them. Also, the correlation between the variables of the knowledge, attitude and skill is studied with Pearson correlation test.

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T2P32

CHANGING A LABORATORY COURSE TO A MODERN INQUIRY WORKSHOP

M.Poorsabahian, M.Sadrolashraf and F.Ahmadi
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The study reported here was designed to substantiate the finding of previous research on the use of inquiry-based laboratory activities that were done in Shahid Rajaee University on physics teacher students. The authors sought to determine whether use of inquiry activities in laboratory would improve student's knowledge, skills and attitudes as measured by test and reported in course interviews. The experimental group consisted physics lab with students who participated in inquiry activities while the control group was the normal traditional physics lab students. The findings of this research revealed that in the knowledge domain that was no significant difference between the control and the experimental groups. However in physics attitude part the experimental and skills exhibited much better attitude than the control group. Further, the inquiry group students as a whole outperformed non inquiry students.

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HISTORY OF ASPIRIN

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Aspirin is a very common medicine, whose employ is spread around the world. Medical use of products containing derivatives structurally similar to aspirin stretches back to antiquity. Thus, in 3000 BC Egyptians employed some parts of willow against pain and fever, and these products were also present in the pharmacopoeia of China, Classical Antiquity and Middle Ages. Nevertheless, the big success arrived in the mid-eighteenth century, when willow bark extract became officially recognized in England because of its specific effects on pain, fever and inflammation due to rheumatism.

From that moment, scientists tried to find out the active component of these extracts, and finally it resulted to be an organic acid that was called salicylic acid (from the word "salix", the botanic name for willow). In spite of all its excellent medical properties, this acid also produced undesirable side effects (such as gastric irritation). So, another related products were searched in order to avoid this problem. In this way, the French chemist Charles Gerdhardt synthesised the acetyl derivative of salicylic acid (acetylsalicylic acid) in 1853, but he did not pursue it further.

On the other hand, the huge advances in Chemistry from the mid-nineteenth century allowed assigning the structure to acetylsalicylic acid. With all these facts in mind, the young chemist Felix Hoffmann, in 1897, began investigating Gerdhardt´s synthesis of acetylsalicylic acid in the laboratories of the dyestuffs firm Bayer (Eberfeld, Germany). Thus, he arrived to the industrial synthesis of this product and Bayer patented this procedure (Berlin, 1899). The trademark of the acetylsalicylic acid produced was "Aspirin", being one of the first drugs of synthesis. At the beginning Aspirin was produced as a powder but only one year after it appeared as tablets.

The success of this new medicine was so great that rapidly it was sold all around the world. It gained in popularity because of its effectiveness on occasion of the Spanish flu pandemic of 1918.

Bayer, from being a small firm, became one of the most important chemicals companies in that time, thanks to the great production of Aspirin. But after the First World War, it was obliged to give up Aspirin´s patent to United States [1].

Aspirin is perhaps the most familiar and popular of all medicines, always present in our daily life. Even this name is included in the official dictionaries of many languages. On the other hand, its chemical structure is very simple, in spite its high number of properties (analgesic, anti-inflammatory, antipyretic, anti-clotting…agent) and it is very easy to synthesize in teaching labs through a classical esterification reaction [2].

For all these reasons, the history of aspirin can be an interesting way of introducing students some basic contents -both theoretical and experimental ones- of organic chemistry.

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PROJECT: THE ARAB CONTRIBUTION TO THE DEVELOPMENT OF CHEMISTRY IN EUROPE

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Modern Science started emerging in the 12th century in Western Europe, but its roots were in Ancient Egypt, Mesopotamia, and China. The Arabic civilization from the 7th to the 15th century had knowledge of the exact sciences and medicine that was much greater than that of Western Europe. In the Abbasid Court of Baghdad around the 8th century, a massive translation effort occurred of Greek science and philosophy as well as Indian and Persian scientific thought. At that time, the Islamic Empire also included Egypt, Syria, and Persia where the influence of Hellenism and Alexander the Great was high. Islamic scholars made these translations with critical enthusiasm, adding original material. This vast background of knowledge was transferred to Western Europe and, later, translated to Latin.
The infiltration of Arabic alchemy in Europe started in the 12th century, but at that time, the number of these translations was considerably less than for the other exact sciences. In the 13th century a large amount of the alchemist's knowledge and techniques —re-elaborated by the Arabs—was passed on to Europe.
There are several studies about the historical contribution of the scientific heritage of the Arabs to the development of science in Europe, namely, in astronomy, mathematics, and physics. Contributions in medicine and pharmacy also have been studied. However, chemistry, in both its scientific and technological aspects is hardly ever discussed and the studies already undertaken are scattered and so a global overview of this fundamental contribution is not possible. In this project, we propose to study the Arabic contribution to chemistry and its subsequent transmission to the North of Europe through the Iberian Peninsula and Sicily as well as its relevance to the development of modern chemistry.

T3P01

INTEGRATING HISTORY OF CHEMISTRY IN SCHOOL CURRICULA

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The integration of topics related to the History of Chemistry is nowadays recommended in many school curricula. However there is a lack of teaching materials that present a view of Science that is not only a mere collection of facts, but an evolution that is a consequence of a long process of construction [1]. An analysis of school manuals of different times, for different levels [2], showed that although in some cases there are historical notes, these are mostly short biographies or simple curiosities, but there isn't usually any historical perspective of the evolution of chemical ideas [3]
In order to help students understand how Science has been constructed, the teaching materials should contain not only information about historical facts, but also about the processes of Science [4, 5]. Materials of this kind could be prepared with the help of historians of Science and curriculum developers.
Some historical experiments can be used, in laboratories with students, to illustrate what was said. The performance of these experiments in conditions similar to the originally described by their authors, together with a discussion of the conceptual frameworks involved, and eventually changed because of the results of the experiments, can be of great value in education.
One possible example in Chemistry is the classical experiment of Wöhler on the synthesis of urea [6], which is referred sometimes in textbooks as fundamental for the abandon of the theory of vitalism. This experiment, accompanied with a discussion of the changes in paradigms involved, can help students understand the reasons pointed out for the late development of Organic Chemistry.
Another approach to using historical topics corresponds to present the reconstitution of experiments included in ancient manuals with original equipment, in conditions similar to those used in the past. Whenever the schools have the adequate equipment and the necessary chemicals this can be done in demonstrations by the teacher. If not it can be shown in video or in computers.
Note that many young students never saw, for example, a retort or a Kipp apparatus, a polarimeter or a simple colorimeter.
It is important to stress that in both cases the safety rules in nowadays laboratories have to be strictly followed, what did not happen in the past [7], and students should not manipulate the ancient equipment, as it can be impossible to replace in case of damage.
In this communication we present some examples of protocols of this type of experiments, and related activities [8, 9], meant at this different way of approaching school science.

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STUDENTS' IDEAS ABOUT ALCHEMY

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The role of alchemy and its contribution to modern chemistry is sometimes mentioned in chemistry textbooks that refer its relevance for the development of some chemical techniques and primitive equipment. However, the real importance of alchemy in the evolution of ideas in chemistry is not usually recognized. Actually, the study of alchemy is often considered without interest by practicing chemists and chemistry teachers, who feel some discomfort with this heritage [1], that seems to be relevant only for historians of science [2, 3, 4].This does not mean that it is a theme that was forgotten. On the contrary, it is most fashionable nowadays, but usually associated to occultism and witchcraft, as it can be seen in several books [5, 6], TV series and movies. We also can confirm that by browsing in the internet, where we can find millions of entries in many languages, most of them not related to chemistry. The magical aspects of alchemy, like the production of gold by transmutation or the fabrication of the long life elixir, conveyed by these media, are fascinating for students, in particular teenagers, who consume them without any scientific criticism. We think that these ideas may influence the further study of chemistry, being on the basis of several alternative conceptions related to different areas of chemistry [7]. We also think that the introduction of some topics related to alchemy in the chemistry curriculum, could help to discuss scientifically some of these alternative conceptions formed with this "magical" literature. In order to get information about students' ideas on alchemy obtained by this informal learning we used a Word Association Test [8, 9] with students of different levels of basic and secondary school.. In this communication we present the results of this research study.

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THE ROLE OF THE HISTORY OF SCIENCE IN CHEMISTRY EDUCATION

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Science education and suffers from the complexities of the basic theories of science and chemistry, which seduces to introduce science dogmatically from 'first principles', explaining the structure of the physical world and the fundamental laws regulating the behaviour of its parts. Neither the students, nor their teachers have much understanding of the justification of their scientific convictions, established long ago in history on grounds forgotten. It are the results of the scientific endeavour and the contemporary scientific world picture that counts, not the procedures that justified the hypotheses that became convictions in later times. The scientific method, the close relationships between theory and experiment, the provisional character even of established theories, does not belong, at present, to the core of science education. This applies also to first degree university education in the sciences. The scientific method is only learned in the research schools and then in a very restricted way: students are trained in the application of theories and experimental methods considered relevant to the special and narrow field of investigation of the research school. The danger is that research training becomes conditioning towards puzzle solving within a very restricted framework

The close attention of science education for certain problems of modern society and for the technological results of the scientific endeavour is at best the application of current scientific theories to practical problems and, especially in popularized accounts, too often a superficial exposition of practical results embellished with historical or biographical details, more directed towards evoking admiration for, than understanding of science and scientists. Science education, separated from the application of the scientific method, is far away from being an important part of general education directed to prepare the student for an integrated human life in modern society. The history of science and chemistry is a reflection on the scientific method in action.

As a teacher of chemistry in schools during twenty years and, during another twenty years, teaching the history of chemistry to chemistry students and aspirant chemistry teachers,I reflected on the uses of the history of chemistry in science education. My paper will give results of this reflection illustrated by practical proposals for introducing historical aspects in school chemistry curricula. The implementation of these proposals asks for concerted action of historians of science, chemistry teachers and educationalists. That will take energy from the historians, not resulting in research papers but only in the presentation of the history of science in the schools and consequently in a deeper understanding of science and in a broader interest for science and science and chemistry history in and around the schools.

A PORTRAIT FROM CHEMISTRY HISTORY: THE RISE AND FALL OF FRITZ HABER

Aydın TAVMAN
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There have been extraordinary chemists in the world of science, and extraordinary advances in chemistry. Fritz Haber, a German chemist (1868-1935), who discovered that iron acted as a catalyst for the manufacture of ammonia, was one of these chemists. In the beginning of 20th century chemists were constantly studying new methods to make compounds which bring huge social and economical benefits. These studies inspired him and he contributed to progress in chemical industry in the beginning of the century. He received the Nobel Prize in Chemistry in 1918 for his development of synthetic ammonia.

However, Fritz Haber is also known as the "father of chemical warfare" for his work developing and deploying chlorine and other poison gases during World War I. Haber played a major role in the development of chemical warfare in World War I. Part of this work included the development of gas masks with absorbent filters. In addition to leading the teams developing chlorine gas and other deadly gases for use in trench warfare, Haber was on hand personally to aid in its release. His wife, Clara Immerwahr, who was herself a chemist, and many others condemned him for his wartime role. During the 1920s, scientists working at his institute developed the cyanide gas formulation Zyklon B, which was used as an insecticide, and also later in the Nazi extermination camps.

Haber was forced to leave Germany in 1933 because of Nazi persecution of persons of Jewish ethnicity and he moved to Cambridge, England, for a few months. In January 1935, at the age of 66, Fritz Haber died of heart failure in a Basel hotel. His grave is in Basel, Switzerland.

The aim of this study is to remind the life and scientific contributions of Fritz Haber and his chemical warfare endeavors that against scientific ethic.

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THE ORIGIN OF PHYSICAL CHEMISTRY EDUCATION IN TÜRKİYE

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In 1926 Physical Chemistry courses were being presented to undergraduate students for the very first time in İstanbul Darülfünunu (University) which was the only university of Türkiye (Turkey) at that time. In order to commence this new lecture, Council of Ministers prepared a decision no: 2809 date: 23rd November, 1925 [1]. This lecture was named as "Şimifizik and Elektroşimi" (taken from French: Chimie Physique et Electrochimie) in faculty curriculum.
In 1926, a group of professors from various French Universities were invited to İstanbul Darülfünunu Faculty of Science, according to cultural agreement between Türkiye and France. Among these professors, there was only one chemist. This scientist played a considerable role in the education of chemistry in Türkiye. He founded the very first Physical Chemistry Department of Türkiye in İstanbul Darülfünunu Faculty of Science, Institute of Chemistry in January 26th, 1926 [2]. This inaugural professor was Dr. M. Faillebin [3]. The new department was called as Şimifizik Kürsüsü (Chimie Physique Department). The chairman was Prof. Dr. M. Faillebin and the first assistant appointed was İlhami Cıvaoğlu [4] (1898–1989). In the beginning, the lecture was presented as 2 hours theoretical (48 classroom hours of a one-year course) and 2 hours experimental per week. Instructor was "Müderris Mösyö Faillebin" (Professor, Mr. Faillebin).
After M. Faillebin moved to Strasbourg University in 1929, Prof. Dr. Gabriel Valensi [5] (1900–1985) who was a French chemist again become the successor of this department. Until 1933 Physical Chemistry Education was carried out by G. Valensi and İ. Cıvaoğlu in Physical Chemistry Department.
During "1933 University Reform" in Türkiye, some instructors were dismissed. For this reason there was only one instructor left at work in Institute of Chemistry of the new İstanbul University in 1934. This instructor was G. Valensi, a physical chemist.
In this work, the first stage of the beginning period of physical chemistry education (1925 – 1933) in Türkiye is studied in detail.

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T3P06

A CASE STUDY ON HISTORY OF SCIENCE: "NOT WITHOUT RESEARCH"

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Learning about history of science is a crucial way of engaging students' in science lessons, helping them to be curious about the events occuring around them and using science process skills to solve problems that they face in their everyday lives. The present study examined the effects of role-playing on students' knowledge about history of science and their attitude towards learning history of science. A study group composed of sixteen sixth grade volunteer students and two volunteer teachers from a private school were formed and they started to work on a play about the lives of eight scientists.

Subjects participated in 60-minute-sessions every week. The schedule of the weeks and the activities conducted are summarized below:

1st Week- Meeting: Because there are students coming from different classes, the first week was planned for meeting. Some games were played in order to enhance group dynamics as well as to make students meet each other. After that, it is explained that they would take part in a play about some scientists. Thus, the first thing that they should have done is to search for some scientists and decide which scientists should they play in the theatre.

2nd Week-Determining the Scientists in the Play: Students brought their reseraches about the scientists as a poster. In their posters they emphasized the period of time that the scientists live, some crucial details in scientists' lives and their contribution to science world. Then, the students have some discussions about the scientists that they have searched. Finally, eight scientists were chosen to be in the play by the whole group.

3rd Week-Exhibition of the Posters: Students exhibit their posters in the Science and Technology classes of the school, because they wanted tos hare their knowledge with the students who are not in their study group.

4th Week- Building the Framework of the Play: Hasan Nami Guner who is a specialist on theatre helped the group to build the framewrok of the play. According to this framework, a teacher gave a homework about scientists to three students. However, s/he does not give the name of the scientists. Instead, s/he epmlaces a clue for every scientist in the play, and wants the students to find the clue and give some information about this scientist. For instance, there is a lamp without a bulb on the teachers' table which means it is a clue for Edison.

5th Week- Role Distribution: The roles are distributed voluntarily. For instance, if a student wanted to play Newton, s/he practiced the role of this scintist.

6th Week- Determination of Costumes & Scenery: Students decided on the costumes and the scenery by taking into consideration of the peroid of time that the scientists have lived.

7th Week- Display of the Game: In order to increase the susceptibility for art and to increase the positive attitutes towards art, the play was displayed on the World's Theatre Day which is the 27th of March.

8th Week- Measurement and Evaluation: Sixteen students that formed the study group conducted the -"Araştırmadan Olmaz-Questionnaire"- to their friends during the breaks in the school, and they analyzed the results. Secondly, a semi-structered interview was conducted with these sixteen students in the group.

Because all parts of the study (text of the play, role distrubution, scenery, costume, representation of the play and so on) was conducted by the students, one instrument of the study-“Not Without Research-Questionnaire”- was formed by them, too. Every student in the group thought about some questions related to a play and they altogether formed one questionnaire. The aim of forming this questioannire is to understand whether their friends who watched the play have learnt something about the scientists or not. Secondly, two teachers of the study group made semi-structered interviews with the sixteen students for two purposes: The first one is to understand whether they learnt something about the eight scientists in the play , while the second aim is to determine whether there is any change to their attitudes towards science.

Not Without Research-Questionnaire was conducted to randomly selected 26 students who watched the play. It is seen that students who watched the play gained some knowledge about the scientists in the play,as well as their attitudes towards scientists have increased.

According to the results of the semistructured interview conducted to the sixteen students who have roles in the play, it can be stated they started to be more interested in science. Moreover, some of them stated that their curiosity towards inventions have increased. Finally, it is asked whether they wanted to have a role in another play or not, and they all agreed upon to have a role.

As it is seen from the results of both the questioannaire and the semi-structured interviews, it can be stated that both the students who have a role in the play and the students who watched the play gained positive attitudes towards learning science.

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T3P07

IMPORTANT SCIENTISTS AND DEVELOPMENTS FORMING BASES OF MODERN CHEMISTRY

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XVIIIth and XIXth centuries are important periods since they form the basis of today's developments. Like several fields, chemistry also saw important basic progresses in this period. In this time, the contributions made by scientists like Antoine-Laurent Lavoisier (1743–1794), Louis-Jacques Thénard (1777–1857), Gay-Lussac (1778–1850), Jöns-Jacob Berzelius (1779–1848), Pierre-Louis Dulong (1785–1838), Sir Humphry Davy (1778–1829), Eilhard Mitscherlich (1794–1863), Frederic Wöhler (1800–1882), Jean-Baptiste Dumas (1800–1884), Henri sainte- Claire Deville (1818–1881), Henry Cavendish (1731–1810), Joseph Priestley (1733–1804), Wilhelm Ostwald (1853-1932), Cato M. Guldberg (1836-1902), Peter Waage (1833-1900),Henri Louis Le Chatelier (1850-1936), Svante August Arrhenius (1859-1927), Soren Sorensen (1869-1939), Alfred Werner (1866-1919), Michael Faraday (1791-1867), Walter Hermann Nernst (1864-1941), Ernest Solvay (1838-1922), Charles Martin Hall (1863-1914), Hermann Frasch (1851-1914), John Dalton (1766-1844), Joseph Proust (1754-1826), Antoine Henri Becquerel (1852-1908), Marie Curie (1867-1934), Alfred E. Stock (1876-1946), Germain Henri Hess (1802-1850), John Newlands (1838-1898), Dimitri Ivanovich Mendeleev (1836-1907), Julius Lothar Meyer (1830-1895), Gilbert Lewis (1875-1946), Fritz Haber (1868-1934), William Henry (1775-1836), François M. Roult (1830-1901), and Karl Wilhelm Scheele (1742–1787) were investigated and compiled.
In this term, although there are important scientists and discoveries, it must necessary to being stated Lavoisier and Dalton seperately due to fact that they brought the chemistry in discipline and system. One of the most important points in this time is, undoubtedly, the progress in nomenclature and terminology of chemistry. In addition, expressing the elements with symbols and determination of atomic weights are other important events.
Many chemists such as Berzelius, Dalton and Scheele made their discoveries with primitive tools in insufficient and modest laboratories. Since this period, thanks to fast development in chemistry and progress in laboratory techniques, discoveries followed each others.

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T3P08

EARLY SCIENCE EDUCATION − MORE THAN BAKING SODA AND VINEGAR?

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The development of Scientific Literacy is a lifelong process, which starts in early childhood. Young children experience the everyday world that surronds us, make first explorative investigations and develop theories about how that world works. Children posess (partly implicit) knowledge and experiences of the natural world, upon which preschools and primary schools can build , to develop basic ideas and skills, and interest in science. These will likely lead to productive efforts to learn and understand science in later grades.
Empirical results show that young children are not only highly motivated for (simple) scientific investigations and questions [1]. They also show their ability to develop basic ideas and explanations of scientific phenomena and investigations [2].
Against this background, in Germany as well as in other countries, there is a (rediscovered) interest in early science education in pre- and elementary school. Syllabuses have been changed, and emphasis also placed, besides other subjects, on science education. Furthermore, a variety of activities have been developed in this context, such as science classes in kindergarten, and materials for experiments that can be performed in kindergarten. If and how these experiments or other science activities are carried out at kindergarten is, at least in Germany, not known. Many early-childhood educators are hesitant about introducing science education, often because they recall their own unpleasant science school experiences. Moreover, only little is known about the appropriate and effective support of science learning in preschool as meeting the needs of subsequent learning at elementary or secondary school.
The paper, which will be presented at the conference, will give insight into the discussion on early science education, and into a beginning project on science learning in preschool and will present the first results of an analysis of science books and internet materials for this age group.

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“MARIA BAKUNIN, 'THE LADY' OF CHEMISTRY"

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"Maria Bakunin was born on February 2, 1873, in Krasnojarsk, an important Siberian city. Maria became, in fact, “preparer” in the Institute of Chemistry in Naples since 1890. She graduated very soon in pure chemistry with a thesis on geometric isomerism, tutored by Agostino Oglialoro-Todaro, an important chemist and Director of the Institute of Chemistry, Straight after Maria became Agostino’s wife and assistant. She dealt with stereochemistry, bringing in an original method to attain the dehydration using phosphoric dioxide: the same method later used to create the aspirin. She also studied pigments and pigment cells, diversifying her researches in a way that we can assert that her scientific dedication coincides with the evolution and the achievement of modern chemistry. She was professor of Applied and Organic Chemistry at the University of Naples, remaining active hereinafter the age of retirement, deserving the qualification of “professor emeritus”. Her home became the Neapolitan centre for scientific and cultural debates of the time and also during the striking moments of German occupation in the second world war. As suggested by Benedetto Croce, she became president-elect of the Pontaniana Academy and her devotion to duty and teaching gave the possibility of training new generations of scientists such as Francesco Giordani and Rodolfo Alessandro Nicolaus. Marias’s protean and complex personality as a scientist was enriched by her contribution in the field of applied chemistry. Her presence in Giffoni Valle Piana, which is a Salernitan province as well as the author’s birthplace, was registred for her consulting offered on the occasion of the ichtyol mining on Picentini hills’ mines. This experience could be considered as a typical example of earlier industrialization in a particular area of the south Italy. Marussia’s existence was intense and credited by mane contemporaries, even if concealed by the presence of the same “illustrious men” that knew and hang out with her such as her father Michail Bakunin, her foster father Carlo Gambuzzi, her nephew mathematician Renato Caccioppoli, and the Stanislao Cannizzaro, Benedetto Croce, Orazio Rebuffat, Francesco Giordani and Rodolfo Nicolaus. Therefore, this is a “gender story”, in the particular history of chemistry, and the aim is to liquefy paths through the narration and the perception of complexity".

DEVELOPMENT OF CRITERIA FOR EVALUATION OF CHEMICAL REPRESENTATIONS IN SCHOOL TEXTBOOKS

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Chemists investigate natural phenomena using the concepts of molecules, atoms and subatomic particles and in order to describe macro and micro world they use a variety of scientific symbols [1]. Thus, chemistry is a science that refers to three levels, the macroscopic, the microscopic and the symbolic [2].
Research studies have shown that meaningful understanding includes the ability to think simultaneously at these three levels, and this presupposes the ability to comprehend, to interpret, to construct and to translate between chemical representations [3, 4]. It has also been shown that chemical representations are relatively meaningless to learners [4-6]. Several studies suggest that teaching should include multiple chemical representations at the three levels of chemistry [3, 5-10]. Since textbooks are the main teaching tools such multiple representations should be included.
This study focuses on the requirements that should be met so that chemical representations in text enhance learning. We propose 5 criteria for the evaluation of chemical representations taking into consideration previous research findings [2, 4-10] and specifications required for visual representations in text [11-13]. These criteria (C1-C5) concern:
(C1) The type of the representation. Representations could be macroscopic, which depict phenomena according to the visual sense; microscopic, which depict the particles of matter; symbolic, which include symbols that are used to represent particles and phenomena; multiple, which represent a phenomenon simultaneously at two or three levels of chemistry; and hybrid, which combine elements from two or three levels of chemistry to form one representation.
(C2) The degree of interpretation of the surface features. A representation is characterized as explicit, implicit or ambiguous, depending on whether the surface features are obviously labeled or not. The interpretation of symbols should be pointed out, so that students will understand clearly the content and the meaning of a representation.
(C3) The relatedness to the text. A representation is characterized as completely or partially related, according to what extent it is coherent and related to text content. A representation should be linked to the relative concepts, principles or phenomena to be taught.
(C4) The existence of caption. Captions are needed to make clear the content of a representation. They should be explicit, brief, and comprehensive and should provide self-sufficiency to the representation.
(C5) The degree of correlation between representations comprising a multiple one. A multiple representation is characterized as sufficiently linked, insufficiently linked or unlinked, according to what extent the correlation between the surface features of its separate representations is clearly indicated. Students should be taught the links between different types of representations in order to be able to translate one type to another.
We believe that the above criteria completely cover all the elements required for a comprehensive evaluation of chemical representations and could be used not only for analysis of school textbooks, but also in designing of new ones. The effectiveness of the proposed criteria was proved by using them in the analysis of the Greek chemistry textbook for the 11th Grade students and the results will be published elsewhere.

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T4O02

AN INNOVATIVE CHEMISTRY TEXTBOOK FOR HIGH SCHOOL

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We are the chemistry team, part of a bigger project, aimed to innovate and strength our 3 years high school system (students age: 16-18) within our university in Mexico City, Mexico. Our student population of above 100 000 is enrolled in two subsystems, an annual (ENP: 9 schools) and a semestral (CCH: 5 schools). In average every student study two minimum chemistry semesters. We have our own teaching programs (last version from 1996, chemistry program is context oriented, lacks official textbooks and have too many concepts to be learn) and our teachers have a honors chemistry B. Sc. background. At ENP we teach 50 students´ groups via regular class lecturing and lab sessions every two weeks in different rooms, whereas CCH groups have 25 students in a room designed to either lecture or laboratory. In this context our project goals were: i) Select the chemistry basic ideas as a starting point to change the actual congested concept chemistry program; and ii) develop brand new textbook and digital resources as reference material for the minimum two semesters of chemistry. To fulfill this project we formed a group of high school, undergraduate and graduate level teachers in may 2005. As common thread we agree on some basic ideas: to promote scientific literacy; to teach less in order to learn it better: concentrate on the central ideas of each discipline that have the greatest scientific and educational significance, even at the expense of coverage; to plan the teaching based on learning principles that derive from systematic research and from well-tested experience; to be consistent with the spirit and character of science inquiry and with scientific values, etc. Then we select chemistry basic ideas, considering its state-of-the-art, relevance for the students level and inter discipline connections: Material, mixture, substance, change, atom, force, property, language, reaction, bond, and energy. The next step was to develop brand new textbook and digital resources (www.conocimientosfundamentales.unam.mx) in 5 chapters in spanish considering innovative ideas: To raise scientific literacy ideas were develop in daily contexts, to help understanding students´ alternative conceptions were contemplated and the scheme from macroscopic observations and experiments to constructing submicroscopic models were followed, to promote classroom communication a gradual introduction to chemistry language was addressed, to keep students´ book interest an informal redaction style, including pictures and caricatures that resemble students looks, motivations, etc. were chosen, etc. To get proper feedback the books were presented and piloted in real classes. Currently we are working in the second edition.

QANTUM THEORY IN SECONDARY CHEMISTRY TEXTBOOK IN GREECE

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The purpose of this study is to examine the presentation of quantum theory in Greek official secondary high school chemistry textbook. Macro-analysis as well as micro- analysis have been applied on the relevant chapter in C class textbook. Macro-analysis of the text showed an incompatibility of label and content. Illustrations [5] considered as being rather extended and 'strong'. Micro-analysis followed a model [6] based on conceptual change theory. Conceptual change theory, as is described by Postner [4], includes accommodation of a new system of ideas and theories in student's conceptual system. For this accommodation to occur on the one hand dissatisfaction and intelligibility of the former-older ideas and theories are needed, whereas on the other hand plausibility and fruitfulness of the new theory are needed. Shiland modified these criteria of conceptual change in order to use them in textbooks. The results of the application of this model for the purpose of micro analysis of the Greek book are as follows:

1. The "dissatisfaction criterion" was estimated by the evidences why the former Bohr model of the atom was abandoned, as inadequate. Instead of evidence a statement "the theory had to be abandoned because it could not explain either spectra or chemical bonding" and a simple reference in the uncertainty principle were found.
2. The "intelligibility criterion" was examined on the basis of the pages needed for the new theory to be elaborated for the reader. We found 8 out of 270 pages dedicated to quantum theory or 2.9 % of the total number of pages. Shiland considered a percentage of 1.9% in USA textbooks as indicative of 'low intelligibility'.
3. The "plausibility criterion" was estimated by the inclusion of experimental evidences of the phenomena explained by the new theory. Instead of evidence the statement "the Schrödinger equation was stated for the mathematical description of the electron in the hydrogen atom. The Schrödinger equation can also be applied in many electron atoms with proper approximations". It is obvious that the simple reference to the mysterious equation [3] is the only 'attempt' of the text to show evidence of the explanative power of the new theory.
4. The "fruitfulness criterion" was examined by the auxiliary material (questions and exercises) included [1]. We only found some exercises and questions demanding simple reproduction of knowledge, but that kind of material cannot be considered fruitful.

Obviously, none of the conditions of the elements required for the replacement of the simple Bohr model with the sophisticated quantum theory were met, according to a conceptual change framework. It is worth noted that the relevant purpose of the Greek National Curriculum states that the pages of the book devoted to quantum theory should mainly help the students understand the reasons for the introduction of the new concepts of quantum theory, as for example the orbital and the electronic cloud. However both macro- and micro- analysis indicated an overemphasis on the Bohr model of the atom, instead of the quantum theory concepts. A finding also included in a former study of Fishler & Lichtfeldt [2].

A study of Tsaparlis & Papaphotis [7] on the meaningful knowledge of students in Greece, showed that secondary students acquire poor understanding of quantum chemistry concepts. Although this is a multifunctional issue, textbooks play a vital role in it.

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T4P02

AN ANALYSIS OF REPRESENTATIONS OF THE PARTICULATE NATURE OF MATTER IN TURKISH CHEMISTRY TEXTBOOKS

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An understanding of Particulate Nature of Matter (PNM) is fundamental in the learning of chemisty. Many research studies exhibit that students have alternative conceptions of particulate nature of matter (1, 2, 3, 4) and discuss possible sources of student alternative conceptions (5, 6). Textbooks especially the use of representations in textbooks have been receiving an increased attention from the education community (7, 8, 9). Therefore, the purpose of the study is to analyze the use of representations of the particulate nature of matter in Turkish textbooks currently used in science classrooms. Five science and chemistry textbooks currently used in Turkey from grade 4 through 12 were examined in terms of the representations of the particulate nature of matter and analyzed based upon three analysis criteria. Preliminary findings indicate that some representations of the PNM may hinder student understanding of the particulate nature of matter. Implications for teaching chemistry will be discussed.

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VIDEO ANALYSIS INTO THE TRAINNING OF PRESERVICE CHEMISTRY TEACHER

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The problem of educational innovations in chemical education might be properly treated by analyzing the complexity on the basis of methodology of teaching. The preservice chemistry teacher should have deep knowledge of the objectives on the classes, type of classes, topic of the course, preparation of students and other factors, that influence directly and indirectly the results of the educational process. The preservice teacher should know theoretically and practically each one the modern methods and to apply them correctly in practice, together with other methods and technologies [1].

The significance of talk between students and their teachers, and between students, is recognized. Socio-cultural theories of learning draw on Vygotskian theory can provide a way of considering these issues in terms of the way ideas developed on the broader social plane of the classroom may be appropriated by individual learners [2].

The aim of the study is to develop an understanding of the role of discoursive analysis of interactions between teachers and students on the preservice courses and to be able to provide further guidance for teachers on how to consider this issue when they prepare class activities [3].

The data for this case study consisted of: video-stimulated-reflective-dialogues in which video clips of recorded class were watched with the class preservice chemistry teachers and their interpretations were discussed, as well the observations of a sequence of lessons (episodes) in the classroom with data recorded using both fields notes and digital video and analysis through an interpretative analytical framework drawing on discourse analysis.

According to our results that any kind of practice is the best way in preservice chemistry teachers training in which teachers (preservice) interact with students to promote meaning making on the social plane of chemistry classes.

On this way, digital videos can be used to initiate reflective processes and support the discoursive interactions analysis of the classroom.

We consider discoursive analysis an important tool to foster the professional development of teachers. In our point of view, learning as a social process, all participants are jointly responsible during these activities.

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ARE SENIOR PRE-SERVICE CHEMISTRY TEACHERS AWARE OF THE STUDENTS' MISCONCEPTIONS RELATED WITH PARTICULATE NATURE OF MATTER (PNM) IN THE CONTEXT OF GASES?

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Pedagogical Content Knowledge (PCK) is a special knowledge that differentiates teachers from content specialists. Shulman [1], who mentioned PCK firstly, viewed it as an amalgam of content and pedagogy.
One of the models including five components was asserted by Magnusson et al., [2] for PCK. One of the components is the knowledge about students' understanding of science topics which is related with the knowledge of student difficulty and their causes [2].
Results revealed that students have misconceptions in PNM [3, 4, 5, 6]. Since the topic is basic for the further learning, teachers should be aware of the misconceptions, moreover; they should try to help learners to eliminate them.
The purpose of the study is to determine whether senior pre-service chemistry teachers are aware of the learners' misconceptions on the topic.
Are senior pre-service chemistry teachers aware of learners' misconceptions related with PNM in the gas context?
A class vignette was administered to 47 senior pre-service chemistry teachers (34 females and 13 males) from two different universities in Ankara.
A class vignette including six open ended questions taken from the research in literature was administered. The instrument was reviewed by an expert with PhD degree in Chemistry Education. For this study, 1st and 3rd questions were analyzed.
To analyze data, qualitative approach was used. Firstly, two categories, which were aware and unaware, were formed. Answers including a prediction about learners' misconceptions were placed aware category while no answers were placed into the unaware category. Secondly, two subcategories, namely, likely and unlikely, were formed under aware category. The former includes misconceptions detected in the literature while the latter does not.
Answers were independently evaluated by two researchers one of which was the first author and the other was her colleague studying for a PhD in chemistry education. After discussions on the answers, agreements were adopted.

	Aware		Unaware
	Likely	Unlikely	
Q1	24 (51%)	10 (21 %)	13 (28 %)
Q3	30 (64 %)	9 (19 %)	8 (17 %)

Table 1. Percentages of answers in the categories

28 % and 17 % of pre-service teachers were unaware of learners' misconceptions for respectively 1st and 3rd questions. The percentages of the unlikely predictions of pre-service teachers were 21 and 19, respectively. Additionally, 51 % and 64 % of the participant predicted learners' possible misconceptions detected in the literature.

In light of the results, although more than half of the participants were aware of misconceptions, some of the participants were unaware of the misconceptions. Additionally, some of them predicted unlikely misconceptions. Therefore, in pedagogy courses, learners' misconceptions and difficulties should be introduced. Moreover, reasons of them should be discussed. Van Driel et al., [7] stressed the importance of class experiences and university-based workshop sessions, in which articles related with misconceptions were examined, in order to make pre-service teachers aware of possible misconceptions learners have. Grossman indicated class observation and specific courses as sources of PCK [cited in 8].

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TEACHERS' IDEAS ABOUT FEASIBILITY OF CHEMISTRY EXPERIMENTS AND VIEWS THE VIRTUAL CHEMISTRY LABORATORY

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Chemistry concepts have been regarded as difficult subjects for students by the teachers, researchers and educators. Despite the reasons for this vary from, one of the major reasons is that chemistry topics are very abstract and therefore it is difficult to be constructed. In this sense, laboratory experiments have great role in students' constructing abstract concepts in their minds properly (1,2, 3,4). However; chemistry teachers either cannot make laboratory experiments in teaching periods or have to make the experiments in crowded groups as demonstration experiments because of some reasons about laboratory including insufficient materials and inconvenient laboratories and restricted time to perform experiments (5,6). In fact, laboratories are defined as places where students learn the concepts by involving in and having experiences, and reinforces the concepts, principals and laws by experiments individually or groups (7,8). Taking these limitations of real laboratory environment into account, seeking alternatives of the real laboratory has become interest of science education research. Computer based virtual chemistry laboratories have been regarded as great potential supporters for the real laboratories. Previous research in this area pointed to several important keys of the virtual chemistry laboratory and laboratory experiments. Moreover, these studies indicated that it was superior to the real laboratory especially in terms of microscopic presentation of the chemical events (2,9,10). The aim of this study is to determine chemistry teachers' ideas about feasibility of 9th grade chemistry experiments and views the virtual chemistry laboratory. The study was carried out in the spring term of 2007-2008 academic years. The sample consists of 20 chemistry teachers from different high schools located Trabzon. To collect the data the semi-structured interviews were used. Four questions were asked to the teacher. As a consequence of analysis; the majority of teachers said that they couldn't make laboratory because of the consuming time and the crowded classes, students had difficulties about mole and solubility concepts, animations should have been used to show concept at micro molecular level.

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HOW DO PRE-SERVICE CHEMISTRY TEACHERS LINK CHEMISTRY TO DAILY LIFE?

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In the chemistry education literature, there have been many research studies conducted in order to assess students' conceptions of several chemistry concepts [5, 1, 2, 8, 9, 7]. On the other hand, few studies evaluated whether students could explain daily life events by using their chemistry knowledge.

Chemistry is a branch of science, which is closely related to daily life. One of the aims of chemistry education is to provide the application of scientific knowledge in order to explain daily life events. Research studies indicated the difficulties of students in linking chemistry taught at school to their daily lives [3, 4, 6]. Students generally think that chemistry is theoretical and after graduations they will not encounter chemistry; however, chemistry is in everywhere. The purpose of this study was to understand whether or not pre-service chemistry teachers could use chemistry to explain daily life events.

For this purpose, both open ended questions and semi-structured interviews were carried out with eight pre-service chemistry teachers (3 girls and 5 boys) enrolled at a course "Laboratory Experiments in Science Education". Questions related to daily life events were asked to the participants. One of the questions asked was:

It is better for fishes to live in cold water than hot water. Explain why?

Whether the participant could not give any response to the questions, the probe questions were asked as if: How does temperature affect on solubility of gases? How could you relate the solubility of gases with the life of fishes in water?

Qualitative analysis was employed in this study. Two categories, correct and incorrect answers, were formed in order to make sense of the data. The analysis revealed that most pre-service chemistry teachers could not apply their chemistry knowledge in order to explain the reason for the daily life events. Even though the participants could give mostly correct responses to the probe questions which seek for the theory of the concepts, the pre-service chemistry teachers could not relate their chemistry knowledge to the daily life events, in general. Considering the example given above, only three of the participants could give correct answer to that question; two of them could not give any responses to the question; and three of them could be able to relate the daily life event to the chemistry after the probe questions were asked.

The results of the present study have several implications for teacher education. Firstly, daily life examples should be given in courses of the teacher education program. Then, we could not imagine a life without chemistry; therefore, pre-service chemistry teachers should be encouraged to link chemistry with daily life events during their practice teaching. The pre-service chemistry teachers are future chemistry teachers; consequently in order to conceptualize their students' chemistry knowledge they should teach chemistry in a meaningful way considering daily life events.

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T5O05

WHAT ARE THE PRE-SERVICE CHEMISTRY TEACHERS' MISCONCEPTIONS ON ACID-BASE CONCEPTS?

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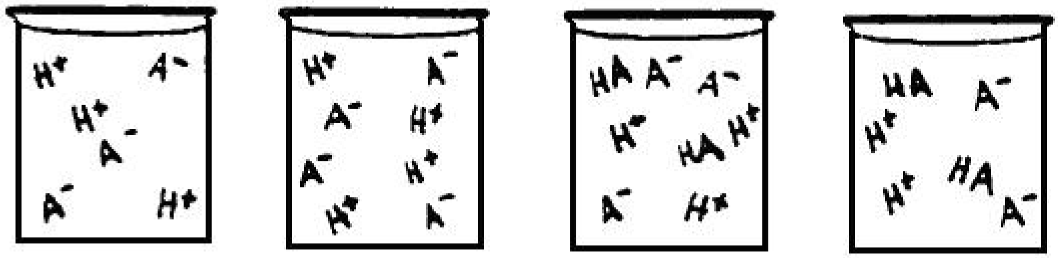
The research studies display that students have many difficulties in achieving in acid-base chemistry [1, 2, 3, 5, 6, 7]. The findings interpret that in high school chemistry the topic of acids, bases, and pH is particularly challenging. In order to understand these topics students must possess a deep understanding of atoms, molecules, ions, and chemical reactions. Understanding this topic is also important for other chemistry units such as the oxidation-reduction reactions and organic chemistry. However, there are not many studies about pre-service teachers' misconceptions on acids and bases concepts.
Therefore, the purpose of this study is to detect pre-service chemistry teachers' conceptions about the acid-base concepts.
One-to-one interviews and multiple-choice questions were conducted with a sample of eight pre-service chemistry teachers (3 female and 5 male) enrolled in the course Laboratory Experiments in Science Education from a university in Ankara. The purpose of the semi-structured interviews and multiple-choice questions were to check the participants' pre-knowledge on the acid-base chemistry. Each interview was tape-recorded; and they were all transcribed for further analysis. The interview questions and multiple-choice questions searched for the participants' knowledge about what they understood from acid and base concepts; how they could describe an acid or a base, whether they knew about acid-base theories and their deficiencies, whether there was an unknown material how they could decide it was an acid or a base, their knowledge about the weak acids and weak bases and strength of them.
Interviews and multiple-choice questions were used to collect data. In order to analyze the data, coding was made and categories were formed for interviews. The categories were correct, partially correct, and incorrect responses. Codes came from both the literature and the researchers' experiences. The multiple-choice questions which have one correct answer and three distracters were categorized such as correct or incorrect answers. In light of researchers' experience and literature [7] the multiple-choice questions were organized.
An example of interview questions:
Which of the acidic solutions below have the highest pH value? (All solutions have the same volume and HA represents the acidic solution). Explain why?



The results reveal that the pre-service chemistry teachers had some misconceptions about the acid-base chemistry, such as:
Strong acidity is related with molar concentration of hydronium ion.
The pH increases as $[H^+]$ increases.
Acids are dangerous.
An acid is H^+ ion donor; a base is OH^- ion donor.
These results have some implications of teacher education, education faculties need to devote continuous efforts to identify pre-service chemistry teachers' conceptions about several chemistry concepts and implement teaching approaches that promote conceptual understanding among students. It is important for teachers that how they conceptualize their chemistry knowledge, because the teachers are the most important persons who give the students idea about chemistry. Therefore, pre-service teachers should be aware their misconceptions and remedy them.

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T5O06

PRE-SERVICE CHEMISTRY TEACHERS' SUB-MICROSCOPIC KNOWLEDGE ABOUT SOLUTIONS

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Solutions is a basic topic in chemistry, however, studies [1, 2, 3] showed that students at different levels have problems in solutions. One of the reasons for the problems in learning solution chemistry is that understanding the topic is much related with other topics such as density, particulate nature of matter, volume, mass and physical and chemical change [4].
Another reason may be the nature of the chemistry that includes three levels of knowledge, which are macroscopic, submicroscopic and symbolic level. Macrochemistry provides knowledge, which can be seen or felt with senses while sub-microchemistry is related with atoms, molecules and ions. Finally, symbolic chemistry means formulas and stoechiometry [5]. It was found that many students did not have adequate sub-microscopic information in chemistry [6]. One of the reasons of it may be that in daily life people use macroscopic mode of thinking. However, in learning chemistry, sub-microscopic and symbolic levels are necessary for meaningful understanding. Johnstone [7] indicated that only seeing yellow solid does not make sense in terms of chemical events and phenomena in which the yellow solid takes part in. Unfortunately, students may not think chemical reactions or phenomena by using all of the levels due to burden on working memory [7]. Studies pointed out that learners generally do not prefer to use atomic and molecular models in chemical events [1, 8, 9].
The purpose of the study was to examine the pre-service chemistry teachers' sub-microscopic knowledge about the solutions.
What is the level of pre-service chemistry teachers' sub-microscopic knowledge about the solutions?
Semi-structured interview was conducted with eight pre-service chemistry teachers (3 females and 5 males) enrolled in a laboratory course.
Draw the figure of salt-water solution and sugar-water solution via considering particles. Explain your drawing.

Four of them did not draw water molecules in the solutions, in other words they only drew ions or sugar molecules. Moreover, some of them could not show sugar molecules in solution (Figure 1).

Figure 1: Solutions with no water molecules

On the other hand, five of the participants showed water molecules in the solutions. Four of them took into account that the positive part of the water dipole is oriented toward the Cl- ions, and the negative part of water dipole is oriented toward the Na^+ ions (Figure 2).

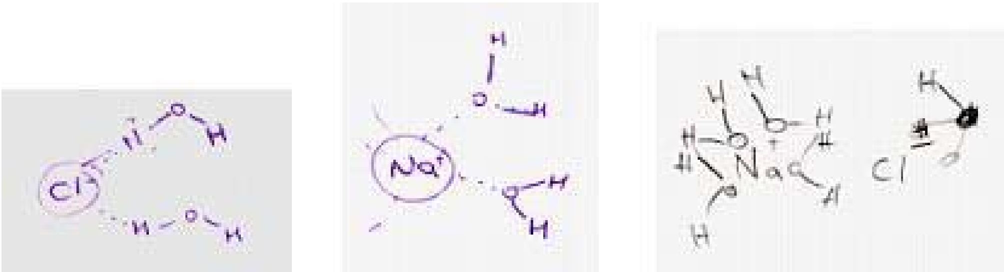

Figure 2: Attraction with Na^+ ion and negative end of water molecules

None of them took into account the hydration number which is 6 for Na^+ and Cl^-.

In light of the results, it can be said that learners have problems in sub-microscopic level of the solutions. The reason of it may be that students do not prefer to use models in describing chemical events as mentioned in the study of de Vos and Verdonk [9]. Therefore, sub-microscopic level should be integrated into chemistry and laboratory courses [1]. In curriculum, materials which support and provide use of atomic and molecular model should be integrated. Moreover, teachers should use these models in the classroom [8].

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PRE-SERVICE CHEMISTRY TEACHERS' SENSE OF EFFICACY AND THEIR ATTITUDES TOWARDS TEACHING AS A PROFESSION

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Teachers' sense of efficacy which is rooted in social cognitive theory is an important factor determining teachers' behaviors and actions [1]. Teacher efficacy is defined as "the teacher's beliefs in his or her capability to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context" (p.233) [2]. Teacher efficacy has been found to be related to positive teaching behavior, teaching performance, student achievement, and student motivation [3]. Teachers' attitude towards teaching profession is also predictor of their behavior and success in teaching profession. Promoting pre-service teachers' attitudes towards teaching profession and their sense of efficacy will improve their performance in teaching.

The purpose of this study was threefold: (a) to describe pre-service chemistry teachers' sense of efficacy, (b) to describe their attitudes towards teaching as a profession, and (c) to investigate the relationship between teacher's efficacy and attitude toward teaching as a profession. The participants of the study were 157 pre-service chemistry teachers (103 females and 54 males). They were first, third, and fifth year students who majored in chemistry education in different universities located in Ankara. The pre-service chemistry teachers' efficacy beliefs were measured with the Teachers' Sense of Efficacy Scale (TSES) developed by Tschannen-Moran and Woolfolk-Hoy [4] and adapted into Turkish by Çapa et. al. [3]. The scale consists of 24 items in 9-point response format (from 1 = "Nothing" to 9 = "A Great Deal"). It has three subscales as efficacy in Student Engagement (SE), efficacy in Instructional Strategies (IS), and efficacy in Classroom Management (CM). To assess the pre-service chemistry teachers' attitudes, Attitudes Towards Teaching as a Profession Scale (ATTPS), developed by Çapa and Çil [5] was used. It includes 25 items in 5-point response format (from 1 = "Strongly Disagree" to 5 = "Strongly Agree) and has two subscales; like-dislike and respect.

Results showed that the pre-service chemistry teachers had high sense of efficacy and positive attitudes towards teaching profession. Bivariate correlational analysis revealed that there was a positive correlation between SE, IS, and CM subscales of TSES and like-dislike subscale of ATTPS. In addition, there was a positive correlation between SE and respect subscales. This means that the pre-service teachers with high score on the subscales of TSES also had high score on the like-dislike subscale of ATTPS and the pre-service teachers with high score on SE subscale of TSES also had high score on respect subscale of ATTPS.

Besides training pre-service teachers with appropriate teaching skills and subject knowledge, promoting their attitudes and sense of efficacy in teaching are also important. Therefore, teacher training programs should include activities increasing pre-service teachers' attitudes towards teaching profession and their sense of efficacy in teaching.

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T5O08

TYPES AND FUNCTIONS OF SIMULATIONS IN THE CIEKAWA CHEMIA (ABSORBING CHEMISTRY) HANDBOOK

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Introduced in 2006 into the process of teaching chemistry in Polish schools at the age level of 13-15 years, the Ciekawa Chemia (Absorbing Chemistry) multimedia handbook (Part 1. Chemistry Fundamentals, Part 2. Types of inorganic compounds, Part 3. Carbon and its Compounds), contains pictures, films, animations, dynamic and three-dimensional models, as well as a set of simulations of chemical processes. These simulations are aimed at imitating sensations created both in the laboratory environment and in our imagination. Such computer-aided teaching facilitates exercises preceding experiments, which in turn limits the number of mistakes made during experiments and allows for saving reagents. Apart from that, such simulations contribute to shaping environment-friendly attitudes in students.
Some of the simulations included on the CDs attached to Interesting Chemistry illustrate laboratory techniques, for instance the rules and methods of titration. Not only does such a simulation helps visualize the activities such as the reading the level of liquids in burettes but it also allows one to simulate preparations of solutions of specific concentrations, conduct postcellular observations of sequences, as well as to rewind and replay them. All the simulations teach students how to conduct measurments in a clean and accurate manner. Furthermore, they can be referred to as sources of information for those preparing to carry out chemical analyses, whereas individual modules of these simulations may be used during laboratory classes, thus helping the teacher increase students' efficiency.
The films illustrating the course of chemical experiments are aided by yet another type of simulations. The experiments repesented in the films have been registered in close-up, which allows for both acquainting with respective elements of the laboratory equipment and following successive activities within a given experiment. The experiments presented in the films are chiefly those using substances unavailable at schools, i.e. those which are expensive, toxic, as well as those which produce waste that cannot be easily managed. Computerized simulations' aim is to explain, at a microscopic level, the phenomena normally observed at the macroscopic level. The teacher's book, additionally, contains descriptions of exemplary modes of utilizing particular simulations in class, both in individual and group tasks.
The third type of simulations facilitate and objectivize the control and assesment of students' knowledge and skills. Students are asked to solve a problem; if they handle the task successfully, it indicates that those who approached the problem have not only achieved the required goal, conducted the proper operations, found the necessary data and combined these within a given time limit, but that they have also performed certain activities such as titration, weighing, or assembling the necessary chemical equipment. All of these activities demand such traits of character as accuracy, persistance and diligence.

PRESERVICE CHEMISTRY TEACHERS' VIEWS ABOUT SCIENTISTS

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Scientific literacy is an important goal of science education. Promotion of scientific literacy requires appropriate understanding of nature of science. Nature of science is commonly defined as the values and assumptions inherent to scientific knowledge and development of scientific knowledge [1]. Both students and teachers possess inadequate conceptions of nature of science [2,3,4]. Teachers have a significant role in promoting students' understanding of nature of science. A teacher can not design an effective nature of science instruction without having appropriate view of nature of science [3].

The purpose of this study is to identify preservice chemistry teachers' conceptions about scientists and to determine whether these conceptions are realistic, has merit or naive. A total of 164 preservice chemistry teachers (69% female and 31% male) from three different public universities participated in this study. Of the participants, 11% were at their first year, 28% were at their second year, 12.8% were at their third year, 23.8% were at their fourth year, and finally 24.4% were at their fifth year in their universities at the time of the investigation. Preservice chemistry teachers' ages ranged from 19 to 26.

In this survey research, the Views on Science-Technology-Society (VOSTS) questionnaire, developed by Aikenhead, Ryan and Fleming (1989) was used to determine preservice chemistry teachers' views about scientists. For this study, a total of 10 items were selected from the modified Turkish version of VOSTS item pool [6]. In this study, data were analyzed by using frequency distribution of each item. The scoring procedure proposed by Rubba and Harkness (1996) was used to categorize preservice chemistry teachers' views about scientists. Each statement in a VOSTS item was categorized into one of the three groups: realistic, has merit and naive. A statement is considered as realistic if it demonstrates an appropriate view, has merit if it demonstrates a number of legitimate points, and naive if it demonstrates an inappropriate view.

The results of the study indicated that preservice chemistry teachers had mixed views about the scientists. Some views were consistent with contemporary (realistic) views, some were consistent with traditional (naive) views, and some were between two of these. When the percentages of three groups of views (realistic-has merit- naive) are considered for each item, the percentages of realistic views were found higher than that of naive views in most of the items. The percentages of realistic views were the lowest in the item eliciting the views about 'professional interaction in the face of competition'. Only 13.4% of the participants held the view that most of the scientists cooperate with each other rather than competing. In the item about 'gender effect on the process and product of science', 37.3% of the respondents thought that the discoveries made by male and female scientists are different, but 55% of them thought that the discoveries made by male and female scientists are not different. This study revealed that preservice chemistry teachers did not have an adequate understanding of nature of science regarding the scientists.

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T5O10

SCIENCE STUDENT TEACHERS' IDEAS OF ATOMS AND MOLECULES: USING DRAWINGS AS A RESEARCH METHOD

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Identification and investigation of student misconceptions in chemistry education have been very important for the last two decades. There are many methods for gathering information about students' knowledge and misconception. Individual interviews about concepts, open-ended questions and/or two-tier diagnostic test on specific science topics, concept maps, word association and drawing can be given as the example of these methods. Drawings have been considered as a simple research enabling comparisons about students' misconception and understanding level [1,2]. The purpose of this study is to reveal the science student teachers' basic knowledge and misconceptions about atoms and molecules by use of a drawing method. Data collected from drawings of 31 science student teachers and interview of 10 student teachers attending science teacher training program at the second term of 2007-2008 educational period in Faculty of Education in Adıyaman University. The analysis of the their drawings and interviews showed that the majority of the science student teachers have several misconceptions as well as inadequate knowledge in terms of atoms and molecules. In the light of the literature [3,4,5], the importance of the findings was critically analyzed and some suggestions were proposed to remedy the problems.

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Key words: Atom, molecule, drawings, misconception, science student teacher.

PRE-SERVICE CHEMISTRY TEACHERS' CONCEPTIONS ABOUT REACTION RATE

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Chemistry is full of abstract concepts and difficult to grasp for students most of the time. Reaction rate is one of those topics including many abstract notions. Research studies indicated that students have great difficulties in understanding reaction rate [1, 2, 3, 4]. Therefore, it is necessary to find out students' misconceptions and proper strategies to overcome them. In the context of effect of temperature on rate of reaction, Köseoğlu et al [3], who studied on 10th grade students' conceptions of reaction rate, found the misconception that an increase in temperature decreases the rate of exothermic reactions. Moreover, it was revealed that students could tell the factors affecting reaction rate but could not explain how. These findings were also confirmed by Nakiboğlu et al [4], who studied with pre-service chemistry teachers. Çakmakçı [2], having examined secondary school and undergraduate students' conceptual understandings of chemical kinetics, found the following misconceptions regarding the effect of temperature:

At the same temperature, rates of both exothermic and endothermic reactions would be equal

An increase in temperature (temperature change) does not effect (change) the rate of exothermic reactions. Since exothermic reactions release energy they do not need energy to proceed and a rise in temperature would not affect the reaction rate.

The purpose of the present study is to identify Turkish pre-service chemistry teachers' conceptions of the effect of temperature on reaction rate.

What are the conceptions of pre-service chemistry teachers about the effect of temperature on reaction rate?

49 pre-service chemistry teachers from two different universities in Turkey participated in this study. They were at their 4th and 5th year of their program. They completed all chemistry courses. A test including 12 open-ended questions about reaction rate was given to the participants. However, for this study due to time limitation, only answers of two items are taken into consideration. Moreover, eight pre-service chemistry teachers were interviewed to obtain deep information about their reasoning. For the analysis of data, qualitative approach was used.

Questions

1. What is the effect of temperature on rate of endothermic and exothermic reactions? Please explain in detail.
2. Please give a daily life example to the effect of temperature on rate of reaction.

Analysis of data indicated that 35 pre-service chemistry teachers gave incorrect explanations for the effect of temperature on rate of endothermic and exothermic reactions. Sixteen participants could not give any daily examples and 24 of them gave incorrect examples for the second item. Interviews revealed that students were confused with the effect of temperature on chemical equilibrium and rate of reaction. More than half of them stated that while rate of endothermic reactions increases with temperature, rate of exothermic reactions decreases with an increase in temperature.

In teacher education programs, distinction between effect of temperature in chemical equilibrium and rate of reactions should be emphasized. Furthermore, pre-service teachers should be encouraged to explain effect of temperature on reaction rate by the help of daily life examples. Projects requiring integration of theoretical knowledge and real life experiences can be useful for this purpose.

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T5O12

INTEGRATING COMPUTATIONAL CHEMISTRY INTO CHEMISTRY TEACHER EDUCATION

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Computational chemistry is the fastest evolving discipline in chemistry. Traditionally chemistry has been considered as an experimental subject but due to the vast growth and development in computer technology, the computer-based approaches are becoming more widely adapted in research and education.
A special modelling and visualisation course for chemistry educators has been developed. The course originates from the new educational programme introduced in Finnish secondary schools by the National Board of Education. The course introduces computational chemistry and computer-assisted visualisation as a modern research and educational tool to enlighten important topics and concepts within the scientific dicipline. The topics considered during the course are, for example, energy, stereochemistry, chemical bonding and chemical reactions – all concepts and phenomena appearing in the new educational programme but being traditionally considered very difficult and complex subjects even at university-level chemistry education. The computational methods used are based on modern state-of-the-art computational chemistry research approaches but they are applied with strong educational bias. The course involves interactive lectures, hands-on sessions in the computer laboratory and practical exercises to demonstrate the power and applicability of the approaches acquinted with. Chemistry education research is adapted during the course in order to understand the "effectiveness" of modelling and visualisation in teaching.
Our goal is to give chemistry educators a first hand experience and training to use computational chemistry methods as well as ICT (information and communication technologies) in studying, teaching and understanding chemistry. The course and all its ideas originate from longstanding excellence in computer-assisted chemistry research. Now this knowledge is emerging in chemistry education as a standard educational tool with a strong emphasis of more efficient and more comprehensive understanding of chemistry. The "computational chemistry in chemistry education" course represents a synthesis of high-level scientific research and wide educational experience, which will modernise chemical education on every national and international educational frontier.

PRE-SERVICE CHEMISTRY TEACHERS' PEDAGOGICAL CONTENT KNOWLEDGE ABOUT THE PARTICLE NATURE OF MATTER

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The teaching of the particle nature of matter (PNM) is fundamental topic in chemistry because most of the chemistry concepts such as kinetic molecular theory, atomic structure, bonding, molecules, solution chemistry, chemical reactions and equilibrium are related to PNM [1]. Although there have been many studies in students' misconceptions in this topic [4, 2, 3], little is known about teachers' knowledge of PNM [9]. If the teachers cannot internalize this topic, the students would not be able to understand the PNM concept and they may develop misconceptions. The pre-service chemistry teachers' pedagogical content knowledge development is crucial [7, 8] in internalizing and preventing misconceptions about PNM.

Pedagogical content knowledge (PCK) is defined as a "special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" [6]. This amalgamation is manifested by Shulman [5] as "in a word, the ways of representing and formulating the subject that makes it comprehensible to others".

Therefore, recognizing of pre-service chemistry teachers' pedagogical content knowledge is important because they are future teachers and their knowledge on chemistry topics will play an essential role in students' understanding in the chemistry concepts. For that reason, in the present study, the pre-service chemistry teachers' pedagogical content knowledge of the particular nature of matter was investigated.

What is the pre-service chemistry teachers' pedagogical content knowledge of the particulate nature of matter?

Eight pre-service chemistry teachers (5 female and 3 male), who were in their last semester of the chemistry education program were participated in the study. The data were collected through a test which contains open-ended questions and semi-structured interviews. The test consists of six open-ended questions with at least four sub-questions each related to PNM. These questions measured the pre-service chemistry teachers' knowledge on PNM, as well as the misconceptions on this topic, sources of these misconceptions, and the teaching strategies on how they could remedy these misconceptions. Based on the results of the test, 3 pre-service teachers were selected for interview to collect deeper information about their PCK.

The responses to open-ended which were categorized as correct, partially correct, and incorrect were analyzed by each researcher separately and then interpreted together. The disagreements were discussed to reach a consensus.

The results revealed that the most of the pre-service chemistry teachers were not aware of the possible misconceptions that students could hold on, some of them could explain the source of students' misconceptions, and some of them could set a plan in order to remedy the misconceptions.

Considering the importance of PCK, the teacher education programs should highlight the importance of PCK. Pre-service chemistry teachers should know the appropriate instructional teaching strategies to teach PNM or other chemistry topics. Education faculties should devote effort for pre-service teachers to make them capable of teaching the concepts to be conceptualized.

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SCHOOL PRACTICE – AN IMPORTANT PART OF THE CHEMISTRY TEACHERS EDUCATION

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The structure of the curriculum used in the education of chemistry teachers at the Faculty of Chemistry at the University of Belgrade includes next major groups of subjects: general educational subjects, chemical subjects, the group of subjects dealing with chemistry teaching/learning methods, pedagogy and psychology and, finally, school practice. School practice is performed in a way that each student attends four lessons per week, during the last semester in the final year of studies. The main aim of the school practice is to provide students with oportunity to apply the previously acquired knowledge and skills for the planning and realization of the teaching and learning process of chemistry, as well as for the monitoring and evaluating students' achievements in that process.
Students are included in all stages of teaching process. In order to make their involvement in the school practice systematic, during the first month, every time, they fill charts containing the following information: the type of lesson, the content and title of the lesson, specific aims of the lesson, the main idea how to realize the lesson, teacher's activities, students' activities, relevant activities leading to realization of assigned aims, the list of the teacher's and students' activities regarding the aim of the lesson, well – planned teaching/learning situations, the examples of good reactions of the teacher.
After the first month spent at school, students compare and analyze their charts. The analysis deals with the following questions:
- Wich ideas about the realization of the lesson help to achieve the aims of the lesson?
- What is the relationship between the aims of the lesson and activities performed by teachers and students?
- Is it possible to achieve the same aims of the lesson, but with a different idea how the lesson could be realized?
- What kind of students activities are stimulated by the teachers activities, and vice versa?

After that, students start teaching. Their lessons are recorded and analyzed. At the end of the school practice, students are giving lessons wich are marked. A student is geting the mark in the range beetwen 6 and 10 depending on the quality of his/her performance during the lesson. Marks from two lessons make 30% of the final exam mark for subject Chemistry Didactics.
In the last seven years, the distribution of the students' marks given within the school practice have been moved towards the higher valuaes. The average mark of the lessons given by the students was 8.82 (standard deviation is 1.05, and the variation quotient 11.93, wich shows that the results are homogeneous).

AN APPROACH TO CHEMICAL CHANGE AND LIVING BEING MODELS TROUGH EXPERIMENTAL NARRATIVES: THE CASE OF PRESERVICE PRIMARY TEACHERS' EDUCATION

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Keywords: modelling in science, science education, chemistry education, preservice teachers in primary school.

Models are mediating instruments between reality and theory; they can be considered, along with hypotheses and phenomena explained by them, the basis of scientific theories (Morrison and Morgan, 1999). The task of modelling can be understood as the systematic activity performed by scientists in order to construct and apply scientific knowledge (Halloun, 1996). Or else, as the process of transformation of the world that is performed when we think about it in a scientific way (Izquierdo & Adúriz-Bravo, 2003).

Consequently, modelling in science classes is the process in which an experience is reconstructed, thus changing the ways in which we think, do and talk about science. Trough modelling, we can seek out coherence between three processes –experimentation, thought and communication– in order to approach the ways of thinking, talking and doing that science has constructed.

This paper analyses the essential points that appear when developing didactical proposals within pre-service science teachers under a 'modelling' approach. The investigation is developed in two courses –Didactics of Science and Chemistry. The first course is developed in English using the methodological approach known as CLIL (*Content and Language Integrated Learning*); the second course promotes *chemistry in context*. In the first one, we tackled the model of living being and in the second, the model of chemical change.

We promoted the use of *experimental narratives* (Ramos & Espinet, 2008) as an instrument to report the lab activities, so these narratives (60) were analysed in order to know some factors about the modelling process. Characterisation of the narratives was done according to three structural elements that constitute them: *introduction*, *development* and *conclusion*. We compared the narratives of both groups to indentify differences and similarities in the semantic construction of the models.

The use of narratives in science education is essential to reconstruct experience with phenomena and give them meaning through language; they also constitute a means to facilitate modelling processes (Millar & Osborne, 1998). Narratives are an instrument that reflects the fundamental structure of our mind: *making the private public* (Eisner, 1994).

We will discuss the theoretical framework, the analytical approach and preliminary results during our presentation.

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THE AFFECTIVE AND COGNITIVE FACTORS WHICH EFFECT TECHNOLOGY USAGE OF PRE-SERVICE CHEMISTRY TEACHERS

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The study aims to assess pre-service chemistry teachers' knowledge about technology usage and computer literacy. It is thought that determining these variables will help eliminating the problems in this field in the planning process of the study. Educating managers and teachers who play an important role while applying new Technologies is as important as equipping education institutes. It is not enough only to introduce the personal who will use technology with the technology. The teachers should be taught organizing teaching activities skills by using technology and new teaching methods. To attain this goal, attitude scale towards computer and scientific process skills test were administered to pre-service chemistry teachers. It was observed that pre-service chemistry teacher tend to technology usage and it was determined that their scientific process skills are parallel to their attitudes towards computer.

THE INFLUENCE OF METACOGNITIVE AWARENESS DEVELOPMENT ON PRE-SERVICE SCIENCE TEACHERS' SCIENTIFIC KNOWLEDGE AND UNDERSTANDING SCIENCE

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Science education program at universities aimed to develop not only the scientific knowledge of pre-service science teachers but also their understanding of science. In this study, a first year chemistry lab course was designed to improve understanding of science besides their chemistry knowledge. The sample of the study was 60 pre-service science teachers who took the first year chemistry lab course. During the course all students carried out 10 chemistry experiments. Turkish version of VNOS-C was given as pre and post tests to the control group (n=30) and the experimental group (n= 30). Differently from the control group; the experimental group had semi-structured pre and post interview forms and discussions for each experiment based on scientific knowledge and scientific processes. The inclusion of the discussions and forms provided the students to be aware of their ideas about science on the basis of scientific knowledge and share them. For the control group, students' questions were answered before and after each experiment. Each group prepared reports after the experiments.

Experimental group also experienced some extra research problems or demonstration experiments related to daily life and discussions on the basis of these problems and experiments besides their reports. Grades of Chemistry Lab Course were used as proxy measures of pre-service teachers' achievement. Achievement and science beliefs of experimental group and control group were compared. The results shed light on the importance of the development of metacognitive awareness in chemistry lab course in terms of process skills, understanding science and achievement.

THE IMPACT OF LEARNING STYLES ON THE ACHIEVEMENT, SCIENTIFIC PROCESS SKILLS AND ATTITUTES OF PRESERVISE SCIENCE TEACHERS THROUGH GENERAL CHEMISTRY LABORATORY

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The purpose of this study is to determine the effects of learning styles on the student achievement, scientific process skills and attitutes toward chemistry and laboratory. The Grasha learning styles scale was administered at the beginning at the semester students works as a group based on different learning styles.
Study consisted of sity preservice science teachers; to find out student learning styles and organized laboratory groups; ın order to eveluate student achievement, scientific process skills and attitutes toward chemistry and laboratory, Kruskal Walliss test and Mann Whitney U test were used.
Moreover, achievement, scientific process skills and attitutes toward chemistry and laboratory were also administered at the beginning at the semester as a pre-test and at the end of the semester as post-test.
The results indicated that there is a significant differences between pre and post-test concerning student achievement on general chemistry laboratory and scientific process skills. There is no significant difference was not found between pre and post- test concerning attitutes toward chemistry and chemistry laboratory.

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USING SCHEMATIC REPRESENTATIONS AND EXPERIMENTAL NARRATIVES IN CHEMISTRY TEACHER EDUCATION

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The inclusion of instructional ('didactical') strategies in chemistry teacher education for the Chilean school has had significant advances in the last years. With the aim of diffusing some strategies, we present "schematic representations" (Talizina, 1988) as a mediating instrument in the processes of representing, anticipating and planning experimental practices, and 'narrative functions' as a way to analyse the materials proposed by pre-service teachers.
In this case, we discuss the analysis of the materials that teachers elaborated in an experimental session (42 schematic representations), corresponding to the 'properties of matter'. In the analysis, we used the categories proposed by Ramos and Espinet (2007) in a previous paper.
In the introduction we identified different starting points and ways in which students expressed them first ideas about the phenomenon:

- 40% of them initiate their narrative using only the information provided at the beginning of the experimental activity or in the items of the lab worksheet, and then ask questions;
- 40% of them instrumentally operationalise their proposed problems, and then ask questions;
- 20% of them show some reflective traits when posing problems.

The development contains the longest part of the schematic representation, and incorporates the description of stages (procedures) and what is related to observations, calculation and analysis performed by students:

- 30% of the narratives are highly descriptive;
- 40% incorporate personal reflection related to the phenomenon;
- 30% are explanatory-associative, i.e., they link the explanation about the phenomenon with another theoretical element (for instance, with formulas or chemical reactions).

In the conclusions, we identified students' reflections about the expected ideas and the results of the lab activity, and also see how they contrast these two kinds of data. In this part there are evidences about different conceptions about the importance of experimental activity related mainly with the content acquisition:

- 20% relate the obtained results with the 'neatness' of the applied procedure;
- 10% emphasize the importance of experimental activity;
- 50 % show the importance of the content.

Shorty, the use of schematic representation is a means to operationalise experimental activities and to promote abilities of representation, planning, anticipation and analysis of the experimental activity. The process of transformation of the real world into the world of chemistry that pre-service teachers try to develop, can be seen in their productions if we consider them like a narratives allowing teachers explain what they think, do and talk during the experimental activity.

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STUDENTS' INTEREST IN THE USAGE OF ORGANIC CHEMISTRY IN DAILY LIFE

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It is known that interest is the most important factor which effect students' achievement and attainment of knowledge towards school and lessons [1, 2]. It has been suggested that the school subject, the topic or theme of instruction, the learning context, and the type of learning activity are effective in stimulation of student interest in science education [3]. Learning contexts include the types of activities involved in the learning process and the cultural context in which the topic is taught. A number of studies indicate that learning contexts can make science topics meaningful for students [4, 5].
The aim of this study was to explore the high school students' interest towards to the usage of organic chemistry in daily life. The research design used in the present study was a survey research. In order to determine high school students' interest towards to the usage of organic chemistry in daily life, a questionnaire contains 27 statement sentence was developed and used. The sentences present in the questionnaire were formed by taking in consideration the usage of organic chemistry in daily life. These sentences were used to determine the levels of students' interest to context. The questionnaire which has Likert type scale with four degrees was used to collect data. Croncbach's alpha reliability coefficient for questionnaire was calculated as 0,866 for the results obtained from pilot study. Participants of this study were selected from four different secondary schools in Erzurum, Turkey. Participants were 505 9th, 10th and 11th grades students, 229 were girls and 276 were boys. For the analysis of the data SPSS for windows and Excel software were used.
The most interested sentence in the questionnaire was the mummification techniques used in preserving corpses in ancient Egypt. The mean of this sentence was 3.26 out of 4. In whole study, the girl interest was higher (2.67) than boys (2.54). This difference was statistically significant, ($P<0.05$) according to independent t-test. The results of the present study can be used in the development of curriculum and/or in the design of the text content. In fact, context based approaches, where contexts and applications of science are used as the starting point for the development of scientific ideas, have been taking places in science teaching [6].

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FINNISH CHEMISTRY TEACHERS' IDEAS OF MEANINGFUL CHEMICAL TECHNOLOGY EDUCATION

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The chemistry teacher is in the key position when teaching chemical technology meaningfully. In this case study we have researched the ideas of the chemistry teachers on meaningful chemical technology education in secondary school and high school.
The teachers involved in a supplementary education course of teaching chemical technology. Each teacher made a project related to chemical technology. The main target was to produce material for teaching chemical technology. Materials were primarily meant to be used at teachers' own schools and later to be adapted into other schools. Research subjects were these teachers' reports of their projects (N=19). Reports contain goals of education, implementation and evaluation. These parts have been analysed by content analysis.
The research shows that chemistry teachers' approach chemical technology broadly and with great diversity. They implement the Finnish national core curricula [1,2] very widely. Many teachers mention that one of their goals in the project was making connections to the surrounding society. Another important goal was to link chemistry education to students every day life. Projects dealt with several chemistry subjects for example metals, plastics and forest industry. Projects dealing with industry emphasize the use of chemicals and the environmental effects of industry. Considering the use of chemicals teachers wanted to point out the wide variety of industrial chemicals, products life cycle and safety at work. In some project tasks teachers approached the chemical technology through materials. Students were for example exposed to plastics or fibers. In these project tasks teachers guide students to investigate the chemical properties of chosen materials. Students can use, for example, the internet as a source of information. In many projects teachers pointed out the education of responsible and considerate consuming.
Chemistry teachers consider collaboration very important in teaching chemical technology. Teachers who participated our study think that industry in their neighbourhood is very valuable collaborator and learning environment when planning the chemical technology education. A visit to local industry or public institute like hospital was included in most project works (N=13). Co operation with different companies and schools including students self oriented work were high lighted in high school teachers' targets. In high school teachers intend to have out of school laboratory working with students. Teachers integrated other subjects like biology and health education when teaching chemical technology.
These project are good examples of chemical technology implementation into chemistry teaching. In future we need more research in this area especially in Finland.

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PRE-SERVICE SCIENCE TEACHER ALGORITHMIC AND CONCEPTUAL PROBLEM SOLVING ATTITUDES AND BEHAVIOURS IN THE CHEMISTRY LESSONS

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Nowadays problem solving is important within purposes of all lessons. Problem solving is method of teaching in this century. Therefore problem, structures of problem solving and enhanced success of problem solving are investigated by the most of educators and psychologistes [1]. Primary target of education is to earn skilles to solve problems to individuals in the future. This target can become real if problem solving is center of education [2].

According to Harren, the problem solving is processes of surmounting a real difficulty and of accessing a purpose [3]. General model for problem solving is four sections; 1. The problem understanding, 2. The problem description, 3. The plan application for solution and 4. Verification. According to Morgan, the problem is difficulty in accessing a purpose [4]. According to Olkun and Toluk, the problem can be a state that can be solved if individual has experience and information [5]. Problem solving has two important product. 1. To develop strategy and principle for teached subject, 2. To develop way of thinking for formulating. When the students are confronted with a new problem, they learn to use previous strategy and to develop new strategy. Thus students use the algorithmic and conceptual knowledges and learn them. While numerical expression how to use is important in the algorithmic knowledge, conception is important in the conceptual knowledge [6]. Conceptual knowledge is priority state in the problem solving. According to cognitive field theorists, conception and understanding are important for solving the problem [7].

The purpose of this study is to determine students‘ attitude and behaviours on algorithmic and conceptual problem solving in chemistry lessons. This study was conducted at Istanbul University, Faculty of Hasan Ali Yücel Education, Deparment of Science Education. SPSS 13.0 packet program for analysis of data was used and frequency and percentage of all questions were calculated. Independent samples T-Test technique and ANOVA were used to investigate the results.

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PRE-SERVICE SCIENCE TEACHER VIEWS ABOUT USE OF TECHNOLOGY IN THE GENERAL CHEMISTRY LABORATORY

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Laboratory instruction is a significant component of science education since it serves multiple purposes. Laboratory instruction offers an opportunity for students to gain scientific process skills including asking questions, proposing solutions, making predictions, taking observations, organizing data and making conclusions. Laboratory work also can help students to acquire a better understanding of concepts and principles as the result of concrete experiences. In general, laboratory instruction has the potential for understanding science concepts by fostering inquiry, intellectual development, problem-solving skills and manipulative skills [1]. Furthermore, technology-supported laboratory instruction is particularly useful for experiments that require sophisticated and expensive equipment or long periods of time. Technology-supported instruction can motivate students to understand scientific phenomena and also offers an opportunity for them to replay experiments for careful observations. However, although there has been a lot of research on either laboratory instruction [2, 3, 6] or on computer technologies [1, 4, 5], there is little research done on technology-supported laboratory instruction. Therefore, this study was designed in order to investigate pre-service science teacher views about technology-supported laboratory instruction in the General Chemistry class.
This study was conducted in General Chemistry course taught in fall 2007. Students taking General Chemistry course are supposed to learn the concept of matter, pure matter and separation methods such as distillation, extraction, crystallization, chromatography, and sublimation. Although information about these methods was given to the students in class, students were not able to do these experiments in the laboratory due to the lack of time and equipment. However, these experiments were videotaped in the laboratory by using a digital camcorder. Close shots were taken in order to provide detailed views for students. Then, the videos were uploaded on the class websites by researchers. Therefore, students were able to watch anytime they had access the website. After watching video demonstrations, students were asked to respond an open-ended questionnaire consisting of six questions regarding their views about the video demonstrations shown in the class. Preliminary findings indicate that even though students have positive views about the technology-supported laboratory instruction and they believe that it is much more effective than the lecture alone, they state that they still would prefer to do experiments on their own in the laboratory.

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CONTRIBUTION OF CHEMISTRY LABORATORY WORKS TO LESSON FOR PRE-SERVICE SCIENCE AND MATHEMATICS TEACHER

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Chemistry is based on experiment and observation. Since many concepts in chemistry is complex, it is hard to teach without laboratory work. The laboratory experiments are important to attain both knowledge at the conceptual level and basic skills for lifetime. Laboratory work helps students not only to acquire on understanding of science concepts but also to gain scientific process skills such as forming a research questions, planning a research design, collecting and analyzing data and making a conclusion [1,2].

The experiment becomes very important when the laboratory method is used in the education. Experiments can be used not only to explain natural phenomena but also to verify scientific laws [3]. The difficult science concepts can be easier understood with laboratory practices. The laboratory practices have a great value in the chemistry lessons. Much research has been done on this issue [4-6]. Teachers conducting laboratory activities should acquire some knowledge and skills during their university education [7].

The purpose of this study is to determine significance of chemistry laboratory works for the lesson. The sample of this study consists of preservice teachers at Istanbul University, Faculty of Hasan Ali Yücel Education, Departmant of Elementary Education, Divisions of Elementary Science and Elementary Mathematics Education. These students have to take "General Chemistry Course" and "Chemistry Laboratory" as part of their schooling. In order to collect data, a pencil-paper test was developed. SPSS 13.0 packet program for analysis of data was used. The results were showed as a percentage table and a frequency table. Independent samples T-Test technique and ANOVA were used for evaluation of the data.

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TURKISH PRE-SERVICE TEACHER CONCEPTIONS OF THE PARTICULATE NATURE OF MATTER

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Chemical educators would generally agree that understanding of the Particulate Nature of Matter (PNM) is fundamental in the learning of chemistry (1,2). Atomic and molecular behavior is an abstract concept that is used to explain most chemical concepts. Although understanding of this concept is very important, empirical studies in science education reveal that students have difficulty understanding the particulate nature of matter (3, 4) and they have some alternative conceptions about the PNM (2, 5, 6, 7, 8). Other studies conducted in different contexts (9, 10) concluded that teachers exhibit a wide range of alternative conceptions similar to those of their students. Therefore, the purpose of this study is to investigate Turkish pre-service teacher conceptions of the particulate nature of matter and compare them with student alternative conceptions discussed in the literature. A Particulate Nature of Matter Evaluation Test (PNMET) instrument (11) was translated into Turkish and then administered to pre-service science teachers in order to determine their conceptions of the particulate nature of matter. Participant responses were analyzed under five categories including satisfactory understanding, partial understanding, partial understanding with a misconception, misconcetion and unclear. Preliminary findings indicate that pre-service teacher have some alternative conceptions of the PNM. Implications for teaching and learning chemistry and further research will be discussed.

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TURKISH PRE-SERVICE TEACHER BELIEFS ABOUT TEACHING AND LEARNING OF SCIENCE

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Science education faces a new reform movement grounded on the principles of constructivism (1, 2). The constructivist view of teaching and learning suggests that teachers should be facilitators who help students construct their own understanding based on their existing knowledge. It also suggests that students should be active learners, questioners who are responsible for their own learning (3). Therefore, reform in science education based on constructivist teaching and learning requires a radical shift in science classrooms.

At the same time, teachers' beliefs are receiving increased attention from the science education community (4, 5, 6) . Many scholars consider teachers as action agents and highlight the importance of identifying teacher beliefs in order to successfully achieve any educational reform (4, 5, 7, 8, 9, 10). Therefore, the purpose of this study is to identify Turkish pre-service science teacher beliefs about teaching and learning of science. Data were collected via an open-ended questionnaire consisting of ten questions adapted from the Teacher's Pedagogical Philosophy Interview ([TPPI] as cited in 11). Data was analyzed under five categories. Implications of teaching and learning science and further research will be discussed.

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PRESERVICE CHEMISTRY TEACHERS' CONCEPTUALIZATIONS OF THE NATURE OF SCIENCE, SOCIOSCIENTIFIC ISSUE; GLOBAL WARMING

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The development and assessment of students' and teachers' conceptions of nature of science (NOS) have been concerns of science educators for many years. More recently, emphasis has been placed on providing an expanded view of an individual's beliefs regarding NOS. Pajare, (1992) states that teachers' beliefs may influence their educational practices especially their beliefs about scientific epistemology. Teachers' understandings of NOS then serve as a necessary condition for helping students understandings of NOS (Hanuscin, Akerson & Mower, 2005, p.913). Socioscientific issues involves understanding the content of an issue, processing information regarding the issue, attending to moral and ethical branches of the issue, and adopting a position on the issue (Sadler & Zeidler; 2004). Both NOS understanding and the ability to negotiate socioscientific issues contribute to scientific literacy that, for many, is the ultimate goal of science education. If a person is able to use 'scientific ways of thinking' then he/she necessarily understands at least some aspects of the nature of science; and if he/she is applying scientific ways of thinking to 'individual and social purposes', then he/she is considering socioscientific issues. In other words, the nature of science informs debate surrounding socioscientific issues. These two themes, which are integral to modern science education, are implicitly associated with one another. Therefore this study aims to explore conceptions of preservice chemistry teachers' (PCT) views on NOS and how they interpret and evaluate conflicting evidence regarding a socioscientific issue. A science brief about global warming was distributed to all class of preservice chemistry teachers. PCT were asked to answer five questions related with the story of global warming and nature of science. According to responses of whole classroom, 5 PCT interviewed deeply about some aspects of nature of science and their responses about cases were given back to them in order to make them to remember their responses. Then the same questions were asked again in order to acquire deeper information. The sample was selected purposeful from the data obtained from teachers' responses. The study utilized phenomenological qualitative research design. Data obtained from the interviews were coded thematically. Although the investigation examined only three of many aspects of NOS, PCT exhibited diverse ideas. Even if the present sample may not be representative of all PCT, it provided insight into how these PCT conceptualize NOS and socioscientific issues. Some of the results suggested that PCT generally understood certain NOS concepts whereas some results indicated a highlighted need for instructional attention.

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T5P15

CHEMISTRY TEACHER EDUCATION IN THE CZECH REPUBLIC

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The development of initial chemistry teachers training in the climate of continuing change is an important issue in the Czech educational system. The Czech Republic ranks among countries with a highly developed educational system and qualified teaching professionals. Secondary school teachers of all subjects undergo training at universities.

The quality of chemistry teachers at secondary schools has become a key factor in the context of government educational change. It means new National program of educational development, framework educational programs and school educational programs.

An important goal of this change is the implementation of three step chemistry teachers studies at universities in the context of Bologna process. The new curriculum at the Faculty of Science, Charles University in Prague started in the academical year 2002/03.

In the bachelor level (three years study, 180 credits) the curriculum contains the compulsory courses in major chemistry disciplines – general chemistry, physical chemistry, inorganic chemistry, organic chemistry, biochemistry, analytical chemistry, toxicology, laboratory courses in these disciplines, mathematics, physics, basics of pedagogy and psychology and general questions of chemical education.

The master curriculum (two years study, 120 credits) is aimed mainly at didactics – didactics of general, inorganic and organic chemistry and biochemistry, school laboratory experiments and pedagogical practice. Students have to pass the exams of advanced courses in chemistry (minimum of 6 credits). A bachelor project (bachelor thesis) is completed within the bachelor study programme, a diploma thesis is completed within the master study programme. At the master level, there are main teaching and learning methods, tutorial system, teaching in small groups, problem-solving, multimedia teaching techniques.

The graduates from master level can apply for the third stage of university education – PhD study. In 2004, the Faculty of Science launched the PhD study program for Education in Chemistry. Within this study, designed as a three-year study, the basic problems of contemporary chemical education are solved at all the respective levels. Students of this form of study will further expand their knowledge of chemistry, pedagogy, psychology, and didactics of chemistry. Their main goal is, however, independent work and solutions to current problems of chemical education at all the respective levels and in all areas.

The comprehensive examinations (state final examinations) are at the end of the Bc., Ms. and Ph.D. study. The part of this exams is oral state exam and defence of Bc. project, Ms. thesis and Ph.D. thesis. All study programmes will be designed to develop concept issues related to the education in the respective subjects in accordance with current European trends.

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T6O01

TEACHING ENVIRONMENTAL PROBLEMS CAUSED BY STUBBLE FIRES, OZON LAYER DEPLETION AND VEHICLES THROUGH PROBLEM-BASED LEARNING

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This study aimed at application of problem-based learning to environmental problems in environmental chemistry course. The sample of the study was composed of 58 undergraduates from the Primary Science Education Departments of Kazım Karabekir Education Faculty of Atatürk University. The study was designed as quasi-experimental, and 31 students were in the experimental group, while 27 students in the comparison group. The titles were taught were stubble fires, ozone layer depletion and environmental problems caused by vehicles. During 2007-2008 academic year for 14 weeks period, problem-based learning was administrated in the experimental group, while a traditional teaching approach was employed in the comparison group.

The data was collected through three scales called “Stubble Fires, Environmental Problems Caused by Vehicles, and Ozone Layer Depletion Concept Test”, “Scientific Process Skills Tests” and “Students’ Views Questionnaires”. The results are analyzed and compared by independent sample t-test. The findings indicate that experimental group was performed better than comparison group. Moreover, scientific process skills were much better in the problem-based learning student’s compared to the control group students. All of the participants also showed improvement in the attitudes towards the environmental problems when compared with their pre-test results.

Keywords: Problem-based learning, scientific process skill, environmental problems, stubble fires, vehicles and environmental problems, ozone layer depletion.

T6O02

IMPORTANCE OF VOC LEVEL IN THE ATMOSPHERE: EMISSION SOURCES AND DESTRUCTION TECHNIQUES OF VOCS

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As the air quality becomes increasingly deteriorated in cities world-wide and people were concerned for their health, air quality monitoring has extended beyond the criteria pollutants (carbon monoxide, sulphur dioxide, oxide of nitrogen, ozone and particulate matter) to include measurements of some toxic air pollutants (TAPs) such as volatile organic compounds (VOCs)[1].

Volatile organic compounds, are organic compounds that easily become vapors or gases. A wide range of carbon-based molecules, such as aldehydes, ketones and hydrocarbons are VOC's. Along with carbon, they contain elements such as hydrogen, oxygen, fluorine, chlorine, bromine, sulfur or nitrogen. Emissions of a large number of anthrogenic volatile organic compounds (VOCs) are prevalent in urbanized areas. VOCs play an important role in the formation of ozone and photochemical oxidants associated with urban smog. Interest in determining the VOCs in the atmosphere has increased over the last several decades. Researches have focused on the levels of VOCs, especially aromatic and chlorinated organic compounds, due to the known and suspected carcinogenic nature of these species

VOCs are considered an important group of air pollutants and automobile, printing, pamting, storing, pumping of gasoline, oil refinery, chemical processes in which organic compounds are used as solvents or reactive chemicals are major emission sources of VOCs[2]. Besides causing localized odor problems, VOCs could be precursors of the ground level ozone and photochemical smog formation. Because every day thousands of tons of dangerous chemical pollutants are emitted to the environment and exert a negative effect on the ecosystems. From an environmental point of view, it is necessary to limit and control vapour emissions because they affect the change of climate, the growth and decay of plants, and the health of human beings and all animals.

There are many different techniques available to control VOCs emissions. These techniques are basically classified into two different groups; process(equipment) modification and add-on-control techniques[3]. In the first group, control of VOCs emissions are achieved by modifying the process equipment, raw material, and/or change of process, while in the other class an additional control method has to be adopted to regulate emissions. Though the former is the most effective and efficient method, its applicability is limited, as usually it is not possible to modify the process and/or the equipment. The techniques in the second group are further classified into two sub-groups, namely the destruction (that consists oxidation (thermal, catalytic oxidation, reverse flow reactor) and bio-filtration) and the recovery (that consists absorption, adsorption (zeolite based adsorption, activated carbon based adsorption), condensation, membrane seperation) of VOCs.

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ICT PROJECT ON CLEANING OIL SPILLS

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A special ICT project for chemistry students intending to work in industry was designed at the Faculty of Chemistry in Belgrade (Serbia). Students were studying the fourth (last) for B.Sc. (Chemistry) and they had previous experience with the searching of internet and scientific data bases. After the short introduction about the transport of oil by tankers and problems with large oil spills which occurred after ocasional accidents, each student received the specific task for study using internet. All tasks were related to oil spills and each student had to prepare a short report and give it to the professor and other colleagues. In the later phase students were divided in two groups and each of them indepedently continued the internet research to study scientific papers and other information on the use of bioremediation for cleaning up Alaskan oil spill after the disaster of oil tanker Exxon Valdez. One of the teams had to write the report with provisional title 'The problems with Alaskan oil spill are almost completely solved' and the other 'There is still a lot of problems with Alaskan oil spill'. Finally, the debate between two teams coud be organised and all collected material will be rewriten and published in the Final report on oil spills, in the form similar to scientific papers/reports. This activity was important for development of ICT and communication skills as well as the scientific and techological literacy of students. It was also a good practice in searching scientific literature and improving their English.

Keywords: Oil Spill, Bioremediation, Petroleum, Internet/Web-Based Learning, Inquiry-Based Learning, Scientific Literacy, Technological Literacy

ENVIROMENTAL ANALYTICAL CHEMISTRY WITH EDUCATIONAL PURPOSES: MEASUREMENT OF DISSOLVED OXYGEN AND CONDUCTIVITY IN WASTEWATERS

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Some of the most important and critical analytical parameters in wastewater from sewage treatment plants are the dissolved oxygen (DO) and conductivity. This DO is measured with the use of a DO-meter and conductivity with the use of a conductimeter [1].
In most of cases, pupils do not know exactly how these measurement instruments respond. Calibration routines for dissolved oxygen probes often use a two point linear calibration where one point is at zero mg/L oxygen and the second point is at saturation or equilibrium with the atmosphere [2]. The zero measurement is not zero volts due to the conductivity of the electrolyte between the electrodes as well as any errors in the analog signal conditioning circuit. For the circuit and probe system used in general, the zero measurement is approximately 1 mV (where approximately 200 mV corresponds to saturation levels of oxygen) and hence the zero measurement is not significant. Thus a single point calibration is used. If desired the probe can be coupled with a temperature probe to achieve temperature compensation since the permeability of the membrane probe varies with temperature.
Conductivity measurements are made with an instrument called conductimeter. Variables such as the employment of alternating current (AC), its frequency, cell constant and temperature coefficient must be account by pupils for have a good understanding of them.
The aim of this work was leaded for improving students´ attitudes toward, and their conceptual understanding of, DO and conductivity measurements.
The proposed study was too a suitable teamwork exercise for improve some analytical chemistry concepts and is also useful to instructors by providing information and feedback on the degree of assimilation of the taught material by the students.
In our laboratory this experiment is scheduled in two to three three-hourlab sessions, but, as the experiment is modular, work can be easily tailored to the structure of each course and the time availability.

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HOW DO CHEMISTRY STUDENT TEACHERS EXPLAIN REAL WORLD AROUND OF THEM?

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Chemistry science is linked with real life tightly so it is essential to connect chemistry concepts with real life experiences in chemistry teaching. In this study, we aimed to investigate if chemistry student teachers be able to use their chemistry knowledge on chemical kinetics to explain real life experiences or not. An open ended questionnaire was used which consist of eight questions on real life phenomenia about reaction rate and the factors effecting reaction rate and a semi-structured interview was conducted. The questionnare was carried out with thirty three chemistry student teachers and eight of them participated in interviews. By analysis of data in detail, some deficiences were determined. Findings show that however students using scientific explanations occasionally they could'nt made sufficient scientific statements. Addition to this, students have preferred superficial explanations instead of scientific explanations in questionnaire and their explanations have troublesome statements. Chemistry student teachers have some misconceptions and difficulties similar to high school students expecially in temperature effect in reaction rate. Furthermore, the study pointed out that chemistry student teachers have troubles about integrating their chemistry content knowledge with daily life. In light of findings some suggestions were made for development of chemistry teacher education programme.

SYNTHESIS OF COUMARINS IN AN IONIC LIQUID: AN ADVANCE UNDERGRADUATE PROJECT OF GREEN CHEMISTRY

E. Tojo, F. Santamarta, P. Verdía
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Over the past decade, ionic liquids (ILs) have attracted great interest because of their unusual properties, including negligible vapour pressure, broad liquid temperature range, and high capacity as specific solvents [1]. One of their main applications is its use as substitutes of traditional hazardous and polluting volatile organic solvents. They have been used in a number of reactions as solvents and/or catalysts with considerable success, often accelerating the reaction, making work-up easier, and allowing their own recycling [2].
This presentation describes the preparation of the ionic liquid 1,3-dimethylimidazolium methyl sulfate, [MMIm][MSO_4], and its application on the synthesis of (3-methoxycarbonyl) coumarin via Knoevenagel reaction. The Knoevenagel condensation is one of the most useful C=C bond forming reactions in organic synthesis [3]. It is employed in the synthesis of therapeutic drugs, herbicides, insecticides, functional polymers, fine chemicals and natural products. It is usually performed in organic solvents in the presence of common bases such as piperidine or pyridine. However, alternative approaches have been used, and a number of Knoevenagel reactions using ILs as solvents and/or catalysts have been carried out with considerable success [4].
Coumarin (2H-1-benzopyran-2-one) and its derivatives are widespread in nature. Owing to their importance in many fields of everyday life, such as pharmaceutical, cosmetic, perfume and nutrition, their chemistry has been widely investigated.
This project provides a valuable opportunity for fourth-year undergraduate organic chemistry students to experience the latest innovative ideas in chemical research. The experimental work (two 4-hour laboratory sessions) includes:
a) Synthesis of [MMIm][MSO_4] by quaternization of 1-methylimidazole with dimethylsulfate.
b) Application of [MMIm][MSO_4] as a recyclable reaction medium for the Knoevenagel condensation between salicylaldehyde and dimethylmalonate, and subsequence cyclization to give 3-(methoxycarbonyl) coumarine.
Students are expected to draw the reaction mechanisms and to characterize their reaction products by melting points and IR, ^{1}H-NMR, ^{13}C-NMR and FAB-MS spectra. With this experiment, the students are introduced to:
1.- A multistep chemical operation in which it is possible to separate the intermediates.
2.- An organic synthesis carried out without using organic solvents as reaction medium.
3.- Interpreting IR, ^{1}H-NMR, ^{13}C-NMR and FAB-MS spectra.
4.- Investigating various organic functionalities.
5.- Green Chemistry
Performing this type of synthesis the students may begin to appreciate the importance of using cleaner and safer reaction medium in organic synthesis. This experiment encourages students to think in terms of environmentally friendly chemical processes.

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THE IMPORTANCE OF GREEN CHEMISTRY EDUCATION

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Many students today are profoundly interested in the sustainability of their world. With growing public concern over global warming and greenhouse gases, students want to understand how human actions affect the health of our planet. Students are deeply concerned about pollution. They practice
recycling. Moreover, they want to secure a healthy Earth for future generations. As students of chemistry, they have a unique opportunity to start at the ground floor of the exciting and expanding field of green chemistry.[1]
Green Chemistry has evolved from its roots in academic research to become a mainstream practice supported by academia, industry, and government. While Green Chemistry encompasses human health and the environment, it is guided by very specific principles of chemical practice. The interest in using green chemistry and its practices has extended internationally to become an alternative to traditional pollute-and-then-cleanup industrial practice in developing countries. This evolution is marked by significant contributions from institutions with different goals that are being satisfied through a common mechanism. Green chemistry is the use of chemistry for pollution prevention. More specifically, it is the design of chemical products and processes that are environmentally benign.
Green chemistry encompasses all aspects and types of chemical processes that reduce negative impacts to human health and the environment. At its best, green chemistry is environmentally benign, linking the design of chemical products and processes with their impacts on human health and the
environment. One factor that is greatly speeding the incorporation of pollution prevention into industrial manufacturing processes is the development of green chemistry curriculum materials.
This issue explain the importance of green chemistry education in curricullum mterials.

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ORGANO NAOCLAY AS A GREEN SORBENT FOR REMOVAL OF HAZARDOUS MATERIALS FROM WASTE WATER

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Clay and clay minerals have primary particles with at least one dimension in the nanometer scale; they may be regarded as nanomaterials of geological and pedological origins [1]. Smectites are important classes of clay minerals because of their specific properties such as a high cation-exchange capacity, adsorption high surface area and swelling behavior. The most common dioctahedral smecite is montmorillonite, a 2:1 layer phyllosilicate constituted from ab octahedral sheet located between two tetrahedral SiO_2 sheets. In tetrahedral sheets Si (IV) atoms can be replaced by Al (III) while in the octahedral sheets Al (III) atomsa re substituted with Fe (III) or Mg (II), producing negatively charged layer. The charge imbalance due to isomorphic substitution in the layer is compensated by exchangeable cations located in the interlamellar positions or on the particle surface [2]. Normally, organic surfactants are used to make the surface of clay platelets organophilic and swell the clay galleries. An organophilic surface and interlayer environment can be produced by replacing naturally occurring inorganic exchangeable cations with a variety of organic cations; for example, long chain alkylammonium ions [3]. These modified organoclays, are used in a wide range of particular applications, such as adsorbents for organic pollutants [4] and metal ions [5], reinforcing filler plastics [6] and catalysts [7].
Cadmium is a cumulative toxic metal whose presence in environment has increasing concerning. The main organs for cadmium accumulation in humans are kidney, liver, lung and pancreas. Cadmium toxicity may be manifested by a variety of syndromes and effects including real dysfunction, hypertension, hepatic injury, lung damage and teratogenic effects. For many decades, nickel was regarded as potentially toxic element, since its concentration in various foods was higher than that needed for living organism. Thallium is a rare element in the earth’s crust. Both the element and its compounds are extremely toxic; skin-contact,ingestion and inhalation are all dangerous. In the present work, the potential of organo nano clay was investigated for removal of nickel, cadmium and thallium from waste waters. Different parameters that should be affected the sorption of these ions onto nanoclay were studied. The organo nanoclay was prepared by adding tetradecyldimetylbenzylamonium chloride (TDMBAC) onto montmorillonite. This sorbent is a new sorbent and cheap. It could be used as a cheap and available nano material fort he application of nano material in high school and university for student. The production of nanoclay is simple for learning of the produce of nano material.

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SYNTHESIS AND INVESTIGATION OF OPTICAL AND THERMAL PROPERTIES OF NI(II) AND CU(II) COMPLEXES WITH AZO-CONTAINING SCHIFF-BASE LIGANDS

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High-density optical storage technology which uses a 405 nm short wavelength laser is developing rapidly due to its high optical disc capacity over 23GB. Obviously, the new technology requires a new optical storage material with high performance matching with 405nm laser. Inorganic storage material such as metal(II)-azo complexes can be attracted much attention because they are can provide easier control of the wavelength according to the substituted group, have good thermal stability into organic storage material, and have good solubility in many organic solvents [1].

Herein we report the preparation, characterization and thermal and optical properties of bis[5-((4-nitrophenyl)azo)-N-(4-R-phenyl)-salicylaldiminato]nickel(II) and bis[5-((4-nitrophenyl)azo)-N-(4-R-phenyl)-salicylaldiminato]copper(II) (R= H, OH, OMe, NO2) complexes derived from 5-((4-nitrophenyl)azo)-N-(4-R-phenyl)-salicylaldehyde (R= H, OH, OMe, NO2) schiff base ligands.

The schiff base ligands were synthesized in a tow-step process. In the first step, salicylaldehyde coupled with diazonioum chloride salt obtained from 4-nitroaniline and then schiff base ligands were obtained by reaction of 5-((4-nitrophenyl)azo) salicylaldehyde whit an appropriate 4-R-aniline (R= H, OH, OMe, NO2) by refluxing in mixture of absolute ethanol and dichloromethane[2]. The schiff base ligands have been characterized by IR and 1HNMR spectroscopy. Nickel and copper complexes have been synthesized by using nickel(II) acetate or copper(II) acetate and free ligands in mixture of absolute ethanol and dichloromethane as solvent and characterized by IR spectroscopy and elemental analysis. UV-Vis spectra and TGA curve of the complexes have been studied. All of complexes have a high absorbance in 400-500nm range and thermal stable above 270oc.

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CHEMISTRY – A VITAL PILLAR TO HOLD THE BUILDING NAMED 'SUPPLIES FOR TOMORROW'

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At recent rate of exhaustion of non-renewable resources, not only the existence but also our survival in future could be questioned. This is why Mankind should be seriously concerned how to survive until the next generation of existential resources (materials, energy, etc) will became abundantly available at acceptable price and in needed quantities.
Some of frequently asked questions are:
When the resources of raw-materials will be exhausted, and
Will the shortage of materials, energy, food, water etc. cause a decline of civilization?
These questions are complex and not simple to answer. If they address materials on which our recent civilization was built, as e.g. metals, polymers, etc., the answer is – YES, resources are near to be exhausted! It is only a matter of time scale when we will experience the shortage. Forecasts vary between pessimistic short term and optimistic long term ones.
But, if we extend the list of critical raw-materials and include new ones, some that are abundantly present and practically not exploited up to now, the perspectives of our material's future could be quite different. In this case the answer is – NO, vital resources will last for a while and mankind will continue to exist, multiply and flourish, despite of negative consequences of past consumer society's style of our living.
In order to achieve such a perspective, chemistry (as well science in general) is expected to continue to develop and discover new technologies, new materials and even NEW CLASSES OF MATERIALS, other than the existing man-made materials.
If such an expectation looks unrealistic and even foolish, let us reexamine the near past of our development:
Until the 20-th Century mankind was not aware of the existence (and benefits!) of synthetic polymers, advanced ceramics, composite materials and so, not to mention the fullerenes, nano-materials, etc.
Having in mind the exponential acceleration in the scientific and technical development, why should we not expect that our material's future will depend on some of the raw-materials underestimated and neglected up to now?
Contribution of future discoveries is of crucial importance.
It is my strong belief that Chemistry did not say its last words when the materials are concerned, and that it will help to overcome future shortages of materials, and even master new classes of materials. Sophisticated materials that will satisfy the ever growing needs of tomorrow, but will also exhibit superior properties, and possibly comply better with the environment than the recent ones do.

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OPTIMIZATION CONDITIONS IN THE ANALYSIS OF IMPORTANT COMPOUNDS OF ELAEAGNUSAN GASTIFALIAL USING HS-SPME/GC/MS

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The concept of solid – phase micro extraction (SPME) may have been derived from the idea of an immersed GC capillary column . The SPME apparatus is a very simple device .It consisting a fiber holder and a fibre assembley , the latter containing a 1-2cm long retra ctable SPME fibre . There are two typical SPME applications , sampling gases head space (HS) and sampling solutions. In either case the SPME needle is inserted in to the appropriate position , the needle protecting the fibere is retracted and the fibre is exposed to the environment . The polymer coating acts like a sponge , concentrating the analytes by absorption / adsorption processes extraction is based on a similar principle to chromatography , based on gas – liquid or liquid – liquid partitioning [1-4].Since its invention in 1989 , there has been a rapid growth in the number of application of SPME, evidenced by the growing number of published papers.

Headspace solid-phase micro extraction (HS-SPME) gas chromatography/mass spectrometry (GC/MS) was used to analyze target aroma compounds in *Elaeagnusan gastifalial* flower. The effect of SPME fiber (DVB/CAR/PDMS,50/30µm) and PDMS (100 µm} , adsorption temperature (20-50 ºC), adsorption time (5-45 min),desorption time (2-10 min) and stirring mode were studied to develop HS-SPME condition for obtaining the highest extraction efficiency and aroma recovery. Five main volatile flavor compounds in the studied headspace were: cinnamic acid ethyl ester (62%) , benzene acetic acid ethyl ester (8%) , hexanoic acid ethyl ester (12%) , ethanol (3%) , butanoic acid , and 2-methyl – ethyl ester (2%). Using HS-SPME method for identifying of volatile compounds in *Elaeagnusan gastifalial* flower present a non-toxic , fast disposal costs and simple method of analysis.

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TOWARDS GAS CHROMATOGRAPHY–MASS SPECTROMETRY COUPLING PROTOCOLS FOR BOTH IDENTIFYING AND QUANTIFICATION ESSENTIAL OILS OF AROMATIC AND MEDICINAL PLANT OF THE TUNISIAN FLORA

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Essential oil of Thymus capitatus Hoff et Link is analysed by using four techniques: GC/pyrolyse/MS, GC/FID, electronic impact GC/MS (quadripole), and GC/MS (ion trap). Both major and trace components are analysed. The GC/pyrolyse/MS coupling provides reference to the exact mass compositions without any need of the previously purified references, neither for major or trace components. The comparison between this reference analysis and GC/FID shows that the FID response coefficients may vary by a mean 7% from one component to another. As it was expected, quadripole or ion trap response coefficients vary to a much greater extent (a mean 25%), although the two MS techniques response coefficients are first order consistent.
We conclude that GC/MS coupling could be used not only as it is usual for reliable identifications, but also for a complete quantitative routine analysis of essential oils. Expected precision could be very similar to GC/FID precision provided correcting species by species the MS analysis by a mean value of the response coefficient measured for the MS 70 eV electronic impact ionisation technologies. The GC/pyrolyse/MS coupling is proposed as a relevant tool for analysing reference samples containing trace natural species that could not be purified.

T7P02

THE BENEFIT EFFECT OF VITAMIN E ON TOXICITY OF NICKEL IN LEPUS CUNICULUS RABBITS

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Haepatoxicity of nickel and the utilization of vitamin E to reduce toxicity in Lupus cuniculus rabbits were investigated in this research. Animals were given drinking solutions of NiSO4 6H2O [Ni (II) cation, LD50/5 and vitamin E 4.3 mg/kg of body weight for four weeks. Serum glucose, serum urea, serum creatinine and serum bilurbine concentrations and serum glutamic oxalic transaminase (GOT), serum glutamic pyruvic transaminase (GPT) activities were determined. According to the results, which have been obtained. There was a high activity of GOT and GPT. It was also found elevated concentration of glucose, creatinine, urea and bilurebine in serum. However, the administration of vitamin E led to normal level of the previous parameters. Finally we can say that vitamin E played an important role for the reduction of nickel toxicity. In other words this vitamin is antioxidant, which prevented the effect of radical libres resulted from the unsaturated free fatty acids oxidation, which affect cell membrane especially liver cells.

Key words: Vitamin E, Rabbit, Nickel, Toxicity, Transaminases enzymes.

UTILIZATION OF RUTA GRAVELENS LEAVES AS A BIO-ADSORBENT MATERIAL OF PB(II) FROM AQUEOUS SOLUTION

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Toxic heavy metals found in environment by contaminated industrial wastes [1,2]. Toxicity result when the metal is presented to the organism by way of unusual route [3].The removal of heavy metals from aqueous streams represents a significant industrial waste problem [4]. Pb(II) is a metal ion, which coud be considered to be an environmental cocern [5]. The attention of our work amied to the utilization of Ruta Gravaelens leaves as adsorbent material for removal of Pb(II) ions from aqueous solutions with out any modification. Factors affecting adsorption of Pb(II) such as pH, adsorbent concentration, contact time, adsorbate concentration and temperature were investigated. The investigation data of the adsorption process show that the Ruta Gravelens leaves have a high capacity adsorption of Pb(II) ions from aqueous solutions and follow the second-order kinetics. The expermental results were fited to the Langmuir and Freundlich isotherms. The results indicated that the Ruta Gravelens leaves biomass is suitable for devolopment of efficient biosorbent for removal of mercury from wastewater of chemical and industrial processes.

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STUDY OF SOLID POLYMORPHISM IN COPPER(II) COMPLEXES DERIVED FROM AZO CONTAINING BIDENTATE LIGANDS BY POWDER X-RAY DIFFRACTION

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Schiff base complexes containing different central metal atoms such as Cu, Ni, Co and Pd have been been the subject of recent attentions for their various crystallographic features, enzymatic reactions, steric effects structure–redox relationships, liquid crystalline properties, catalysis, magnetic properties and their important role in the understanding of the coordination chemistry of transition metal ions. This copmpounds are very important both from a scientific and application point of view.[1, 2]

In this work we report some crystallographic aspects of new bis[5-((4-dodecyloxyphenyl)azo)-N-alkxyl)-salicylaldiminato]copper(II) complex homologues (alkyl=butyl , Hexyl) and investigation of solid polymorphism observed in this complexes. All reagents and solvents were used as supplied by Merck chemical company and used without further purification. X-ray patterns were recorded on a Bruker D8 advance powder diffractometer using Cu-Ka radiation(l=1.541 Å), monochromatized from graphite, in 2q rang 1.5 to 30 ° at ambient temperature. Copper complexes were prepared in similar manners using the method described by Nejati et al. elsewhere.[3]

Solution crystallized samples of copper complexes have been examined by XRD for determination of crystallinity and unit cell parameters. XRD patterns of two copper complexes at ambient temperature indicate that the virgin samples(samples crystallized from ethanol/chloroform solution) of complexes are a perfect crystals because of sharp bragg reflections in recorded patterns.

The complexes crystallize on monoclinic system with unit cell parameters of a=19.2673 (0.0521), b=5.5698(0.01102), c=18.3720(0.00298) Å , Beta=94.210º and volume= 1966.26 (for alkyl =n-butyl) and a=118.1980 (0.0421), b=16.2869(0.01002), c=405755(0.00398) Å , Beta=94.239º and volume= 1518050 (for alkyl =n-hexyl) The polymorphism properties of copper complexes upon heating and cooling of samples have been described.

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DEPOSITION, GROWTH PROCESSES AND CHARACTERIZATION OF POLY (DIPHENYLAMINE- CO – ANILINE)

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Copolymerization of diphenylamine (DPA) with aniline (ANI) was carried out in aqueous sulfuric acid (1.7 M) by cyclic voltammetry .The copolymer film was grown on the surface of the working electrode (Carbon-Glass) for various experimental conditions and the charge associated with film depositions followed by cyclic voltammetry. The charge values were correlated to the amount of copolymer deposition (growth) and amount of copolymer deposited per unit time of electro polymerization (growth rate).The kinetics of the electrochemical copolymerization was followed by deducing the growth and growth rate equations in terms of charge associated the deposition and the conditions of electro polymerization. The deduced growth and growth rate functions indicate the dependences of concentration of DPA and ANI. The films were obtained by electro polymerization in solution containing monomers in various ratio(0.0085 M DPA with 0.03-0.13 M ANI) and scan rate 25 mv/s between -0.1 – 0.9 V versus Hg/HgCl2 electrode. Copolymerization was found to be possible only at 0.0085 M DPA to 0.005M ANI ratio. The copolymer was also synthesized through oxidative polymerization via interfacial process in toluene and water mixture solvents with ammonium persulfate and hydrochloric acid at -0.2 – 0 °c .The films were characterized by cyclic voltmmetry, FT-IR spectroscopy and conductivity measurements using four probe techniques.

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EVALUATION ON THE STRUCTURAL AS SELECTIVE ELECTRODES FOR REMOVING TRACE METAL IONS BY SOME ORGANIC COMPOUNDS BY USING SOME QUANTUM MECHANIC CALCULATIONS

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We have recently reported the successful use of some new ionophores in construction of PVC- based membrane selective sensors for Fe+3, Ni+2, Co+2, Hg+2 and Cd+2 ions by some Schiff base ligands. Schiff bases are one of the most important classes of ligand in coordination chemistry. In this present work we reported the optimized structures of four tetra dentate mono azo Schiff base compounds [1-2]. Using AM1, PM3 and MNDO semi-empirical methods for optimization of the compounds, then we have been compared all of theoretical data with experimental data in the literatures. We examined the HOMO and LUMO generated by MOPAC program package. Also we will show the coordination sites for all of these compounds.

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T7P07

A THEORETICAL INVESTIGATION ON THE INHIBITION PROPERTY BY SOME ORGANIC COMPOUNDS AS ANTI CORROSION MATERIALS FOR MILD STEEL

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Most organic substance employed as copper corrosion inhibitors protect the metal by forming a chelate on the metal surface. The efficiency of the inhibitor depends on the stability of the chelate formed. The effectiveness of an organic substance as an inhibitor depends on the structure of the inhibitor. The inhibitor molecule should have centers capable of forming bonds with metal surface by electron transfer, in which the metal acts as an electrophile and the inhibitor acts as a Lewis base with nucleophilic centers. In this present study, the relations between the inhibition efficiency of a group of organic compounds (imines) have been investigated by theoretical methods. In our study we have been used some semiempirical methods by some softweares for predication and investigation of the electronic properties of these compounds. In order to study the ability of quantum chemistry to select corrosion inhibitors, quantum chemical calculation have been applied to the four kinds of organic compounds. The theoretical results obtained have been compared with the data of experiments[1-3].

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T7P08

EXTRACTION OF VOLATILE COMPOUNDS OF CATKIN (SALIX AEGYPTIACA L.) BY SIMULTANEOUS HYDRODISTILATION AND EXTRACTION

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The composition of volatile compounds in herbs has been the subject of many research studies. They are responsible for the wide aroma and therapeutic herb effects [1].The curative efficiency of herbs depends on their quality, the time of harvest, storage procedure and on the climate [2, 3]. Salix aegyptiaca L.has been used traditionally for improving the odor of food and drink and also it is used to treat headache relief due to environmental or nutritional substances, in folk medicine (4). It is also reported gastrointestinal stimulant and emollient of felt, cardiovascular protective effect, laxative or cathartic effect, sedative, analgesic effect on acute pains, increase in libido and gastro esophageal reflux disorder (GERD) (4). The volatile compounds obtained by Simultaneous hydrodistilation and extraction (SHDE) with xylene as solvent using modified Clevenger apparatus was analyzed by capillary gas chromatography (GC) using flame ionization (FID) and capillary gas chromatography mass spectrometry (GC/MS) detection. The data analysis showed that the main compounds of the extract (mass percentage related to total a mount of extract) were 1, 4- dimethoxy benzene, hexahydrofarnesyl acetone, hinicosane and pentacosane.

Key words: Salix aegyptiaca L., volatile compounds, Simultaneous hydrodistilation and extraction

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COMPARISON OF ESSENTIAL OILS OF MATRICARIA RECUTITA EXTRACTED WITH SOXHLET EXTRACTION AND OTHER TRADITIONAL EXTRACTION METHODS

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Chamomile, Matricaria recutita L., is a well-known medicinal plant in folk medicine cultivated all over the word. Chamomile essential oil is widely used in pharmaceutic, cosmetic, and food industries [1, 2]. It is a spontaneous herbaceous perennial plant and its drug is largely used, as an infusion, for its anti-inflammatory properties, especially for respiratory and gastroenteric tracts [3].
In this work the aerial parts of Chamomile was subjected to Soxhlet extraction with different solvents such as n-pentane, dichloromethane and ethanol. Plants were also extracted with water under reflux and then the yields of reflux were fractionated by liquid-liquid-extraction with organic solvent (n-pentane, dichloromethane). The extracts were analyzed by capillary gas chromatography (GC), using flame ionization and capillary gas chromatography mass spectrometry (GC/MS) detection. As expected, significant differences are seen in terms of extraction yields. The data analysis showed that the main compounds of the extract (mass percentage related to total a mount of extract) were bisabolol oxid A and B, 7-methoxy coumarine, en-yn-dicycloether and hexadecanoic acid.

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LIQUID-CRYSTALLINE POLYESTER DENDRIMER

Massoumeh Bagheri
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Dendrimers are fascinating materials which combine unique features (well defined macromolecular structure, monodispersity and low viscosity) with a wide range of applications in the areas of drug delivery, catalysis, nanostructured materials, electrochemical devices and liquid crystals [1]. The combination of mesomorphic properties and dendritic structures is a new approach in the field of liquid crystals. Two approaches have been used to obtain dendrimers that show liquid crystalline arrangements (dendromesogens) [2]. Synthetic chemists have reported dendrimers with rod like or disc like mesogenic groups in periphery of the molecule which can form a liquid crystal shell around the control nucleus [3]. Alternatively, other dendrimer architectures include hyperbranched polymers based on polyfunctionalized mesogens that exhibit nematic liquid crystalline behavior [4]. This paper deals with the later type of dendrimers and reports the synthesis and liquid crystalline properties of new mesomorphic alkoxy terminated aromatic polyester dendrimer based on 3, 5-dihydroxybenzoic acid containing 1, 4-bis (4-hydroxybenzoyloxy) butane [5] as a core. The structure of synthesized compounds was confirmed by FT-IR, NMR and elemental analysis. The thermal behavior of the dendron and dendrimer has been characterized using polarized optical microscopy and differential scanning calorimetry.

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T7P11

FLAME ATOMIC ABSORPTION SPECTROMETRY AND DETERMINATION TRACE AMOUNT OF CU^{+2} AFTER PRECONCENTRATION BY MODIFIED ANALCIME ZEOLITE COATED WITH N, N´- BIS (4- PHENYLAZO SALICYLALDIMINE) 3- CHLORO -1, 2 PHENYLENDIAMINE

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Jahad Agricultural

Recently, SPE cartridges and disks have been widely and successfully used in preconcentration processes [1-3]. They reduce solvent usage, disposal costs, and extraction time for sample preparation and obtain large enrichment factors [4]. In this work, a simple, rapid and sensitive flame atomic absorption technique has been developed for the determination of trace amount of copper in various samples after adsorption of its complex on modified Analcime using a recently synthesized tatradentate Schiff base ligand N, N´- bis (4-phenylazo salicylaldimine) 3- chloro -1,2 phenylendiamine. The influence of flow rates of eluent and sample solution, amount of ligand, types and least amount of eluent for elution of Copper ion from column were investigated.
The effects of various cationic interferences on percent recovery of Copper were studied. The method was successfully applied for the determinations of Copper ion from synthetic and water samples.

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DETERMINATION OF TRACE AMOUNTS OF NI IONS IN AQUEOUS SAMPLES

Abbas Shahidi
Jihad Agricaltural

Recently, SPE cartridges and disks have been widely and successfully used in preconcentration processes [1-3]. They reduce solvent usage, disposal costs, and extraction time for sample preparation and obtain large enrichment factors I have carried out widespread studies on the application of a sensitive and selective preconcentration method for the determination of trace a mounts of nickel by atomic absorption spectrometry. The method is based on sorption of Ni ions on natural Analcime Zeolit column modified with a new Schiff base 5-((4-hexaoxyphenyl azo)-N -(n-hexylamino phenyl)) salicylaldimine and then eluted with 0.1M EDTA and determination by FAAS. Various parameters such as the effect of pH, flow rate, type and minimum amount of stripping and the effects of various cationic interferences on the recovery of ions were studied.

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PREPARATION, ELECTROCHEMISTRY AND ELECTROCATALYTIC ACTIVITY OF LEAD PENTACYANONITROSYLFERRATE FILM IMMOBILIZED ON CARBON CERAMIC ELECTRODE

H. Razmi, B. Habibi, H. Abdolmohammad-Zadeh, H. Heidari

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The development of chemically modified electrodes (CMEs) is still a growing field of analytical science. One important group of inorganic compounds utilized for electrode modification comprises the transition metal hexacyanoferrates (MHCFs). Metal hexacyanoferrates are polynuclear mixed-valence compounds. There has been growing interest in the preparation and characterization of transition metal hexacyanoferrates as electroactive materials due to their potential in electrocatalysis [1], electrochromism [2], solid state batteries [3] and electroanalytical applications [4]. The metal pentacyanonitrosylferrate (MPCNF), a class of polynuclear mixed valance compounds, also have been used for the preparation of thin films in the last years [5, 6]. These research activities encouraged us to use pentacyanonitrosylferrate (PCNF) as mediator compound for derivatization of metallic lead to produce a novel PbPCNF film.

In this work, Lead pentacyanonitrosylferrate (PbPCNF), a new Prussian blue analog, was immobilized on the surface of a carbon ceramic electrode (CCE) prepared by sol-gel method. The immobilization process consists of adding a certain amount of metallic lead to the electrode matrix before gelation, and chemical derivatization of Pb on the electrode surface to a PbPCNF solid film by immersing the electrode in a solution of sodium pentacyanonitrosylferrate (PCNF). The composition of the synthesized PbPCNF was characterized by FTIR, EDX and SEM techniques. The resulting modified electrode showed electroactivity at two redox centers. The electrochemical behavior of the PbPCNF|CCE modified electrode was studied by cyclic voltammetry; the peak current is proportional to the sweep rate up to 200 mV s-1. Under optimized conditions the peak-to-peak separation is only 39 mV, indicative of a surface reaction. Ion effects of the supporting electrolyte suggest that cations have a considerable effect on the electrochemical behavior of the modified electrode. The transfer coefficient (α) and the charge transfer rate constant at the modifying film|electrode interface (ks), were calculated. The electrocatalytic activity of the modified electrode toward the electro-reduction of peroxodisulfate was studied in details.

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IMPACT OF CHEMISTRY EDUCATION IN A MASTER OF WATER SCIENCES

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In the new system of high education, the multidisciplinarity is more and more evocated. In effect, for getting a link to the labor world it is needed for a student to be polyvalent. Thus, the new Masters elaborated in main universities are taking into account of this parameter. In our university a Master of Water Sciences has been proposed and the Faculty of Chemistry has been devoted to drive it. More than 30% of the program concerns chemistry, then, in this presentation, its impact and its role on the Master is discussed. On the other hand, in this Master, students from both Biology and Chemical engineering can apply, then the chemistry courses should be adapted to this situation. The manner to perform these courses is also described.

THE INTERFACE CHEMISTRY/INDUSTRIAL CHEMISTRY ON THE MASTERS OF SCIENCES IN A FACULTY OF CHEMISTRY

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In the faculty of chemistry of the University of Sciences and Technology Houari Boumediene of Algiers, new Masters have been proposed for the next year according to the new system of high education (Bachelor, Master and Doctorate). In the previous years, our Faculty was only devoted to the pure and fundamental chemistry education. This fact has provoked a decrease of the number of students which are more interested by the applied sciences. For this new year and in the way of the educational reform, Masters of Sciences in the Chemical education have been proposed with a direct interaction between the pure and applied Chemistry. As example, a Master of Drug chemistry will be available with a direct linkage with pharmacy. then, in this presentation, we will try to show the impact of this interface and how the chemistry can be more attractive for the students without deviate from its base.

EFFECT OF ORGANIC ACID DOPANTS ON THE CONDUCTIVITY, SOLUBILITY OF POLYANILINE, POLY(1-NAPHTYLAMINE) AND THEIR COPOLYMER THIN FILMS

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An attempt has been made to prepare polyaniline(PNAI), poly(1-naphtylamine)(PNPA) and copolymer(PANI-PNPA) thin films doped by several organic acids(sulfonic acids) using aqueous solution. Effect of sulfonic acid dopant is rarely studied in the field of conducting polymers. Various organic sulfonic acids as dopants, viz. sulfo salicylic acid, *p*-toluane sulfonic acid, methane sulfonic acid, dodecyl benzene sulfonic acid, are used at room temperature. Homo and copolymer thin films were synthesized electrochemically, under cyclic voltammetric conditions in aqueous solutions of organic sulfonic acids. The copolymer compositions were altered by varying the monomer feed ratio during electrosynthesis. The films were obtained by electropolymerization in solution containing monomers in various ratio (0.025-0.1 M) and 1 M dopants as electrolyte. Copolymerization was found to be possible only at low NPA to ANI ratio. The films were obtained by applying sequential linear potential scan rate 25mv/s between -0.2 to 0.9v versus $Hg/HgCl_2$ electrode. The films were characterized by cyclic voltammetry, FT-IR spectroscopy and conductivity measurements using four probe techniques. It was observed that the current densities are strongly influenced by the size and the nature of the anion present in the electrolyte.

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T7P17

TRICARBONYLCHROMIUM COMPLEXES OF 2-SUBSTITUTED-1,4-DIHYDROPYRIDINE DERIVATIVES: REGIO- AND STEREOSELECTIVE REACTIONS

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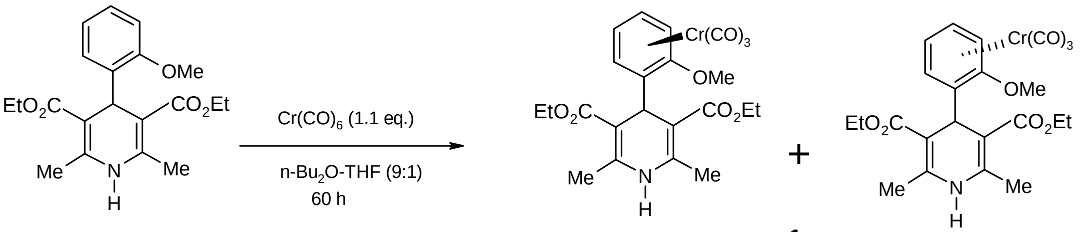
1,4-dihydropyridine esters (Hantzsch esters) represent a potent structural class of therapeutic agents collectively known as calcium antagonists.[1] On the other hand (arene)chromium tricarbonyl derivatives have found wide application in synthesis and in biological applications as probes of drug-receptor binding.[2] Since unsymmetrically 1,2- and 1,3- disubstituted arenechromium tricarbonyl complexes are chiral and are enantiomeric on the basis of which face of the arene the chromium tricarbonyl fragment accupies [3], our attention has focused on the preparation of tricarbonylchromium complexes of Hantzsch esters. Initially, we prepared 1 in enantiomerically enriched form ($[\alpha]_{578}$=-25º (c=1, $CHCl_3$)). Regioselectivity was clearly established as η^6 to the 4-aryl substituent by the ^1H and ^{13}C NMR chemical shifts and enantioselectivity was established by determining the specific rotation of complex. These results encouraged us to preparation of racemic mixtures of 2-substituted -1,4- dihydropyridin derivatives (i.e. 2) and then to separate enantiomers by diastereoselective complexation and decomplexation (see scheme)



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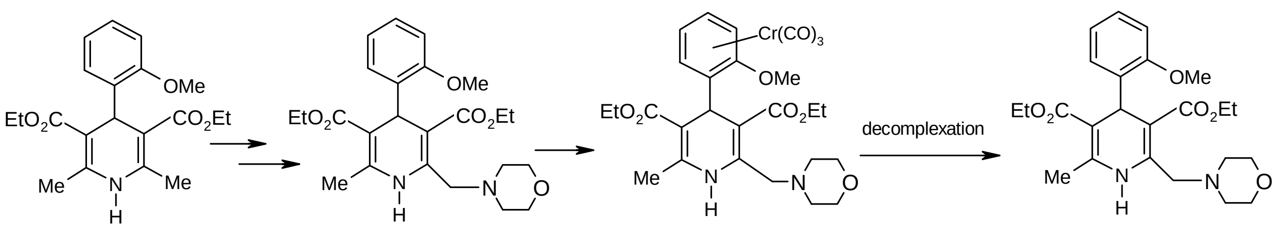

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MEASUREMENT INTEGRATED ABSORPTION CROSS SECTION, OSCILLATOR STRENGTH AND NUMBER DENSITY OF CAFFEINE IN COFFEE BEANS BY INTEGRATED ABSORPTION COEFFICIENT TECHNIQUE

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Integrated absorption cross section and oscillator strength of caffeine in water and dichloromethane were reported by UV-vis spectrometer in the frequency region of 32552-40849 cm^{-1} at room temperature. The integrated absorption cross section in water and dichloromethane was $(26.34 \pm 0.53) \times 10^{-4}$ and $(24.36 \pm 0.42) \times 10^{-4}$ $cm^2 s^{-1} molecule^{-1}$ respectively. On the other hand the corresponding oscillator strength of caffeine in water and dichloromethane were 0.23 ± 0.04, 0.21 ± 0.05 respectively calculated. In addition number density of caffeine in coffee beans was reported using integrating absorption coefficient technique. The calculated number density of caffeine for different coffee varieties was varying from $(9.88 \pm 0.32) \times 10^{15}$ to $(14.31 \pm 0.21) \times 10^{15}$ *molecule* cm^{-3}. The applied technique has an advantage since it is independent of line function which may vary with, pressure and temperature, concentration of the solute and the interaction of solute solvent.

Keywords: Caffeine, number density, integrated absorption coefficient, Integrated absorption Cross section and oscillator strength

EFFECT OF VIBRONIC INTERACTIONS IN ABSORPTION AND RESONANCE RAMAN SPECTRA OF TRANS- 1, 3, 5-HEXATRIENE MOLECULE

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The absorption and resonance Raman spectra due to $1^1A_g \rightarrow 1^1B_u$ of trans-1,3,5-hexatriene (THT) has been studied by many of authors. The bright 1^1B_u state and the dark 2^1A_g state can couple each other via modes of b_u symmetry [1].

In this paper we focus on the model consisting of 8 vibrational modes. We use a diabatic electronic representation and construct the Hamiltonian of the final electronic manifold. We then proceed to present the spectra obtained from time domain theory[2].

The electronic excitations cause change in the ground and excited state vibrational frequencies for some of modes and also a sizable mode scrambling. We consider these changes in our calculations. We evaluate multi-dimensional time domain integrals that arise in the calculation of absorption cross section when the electronic transition take place between displaced, distorted, and rotated harmonic potential energy surfaces.

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QSAR STUDY OF 2-PHENYLNAPHTHALENE SCAFFOLD INHIBITORS ON ESTROGEN RECEPTOR (ER_α): A GA-MLR-ANN APPROACH

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Estrogen receptors as mediators of the estrogens are regarded as members of a superfamily of nuclear receptors. Targeting these Estrogen receptors by ligands can be therapeutically rewarding in treating certain cronic inflammatory diseases. The present study is going to investigate the quantitative structure-activity relationship (QSAR) of 2-phenylnaphthalene ligands on ER. A data set comprising 70 derivatives of 2-phenylnaphthalene consisting of 6 classes is used. The more suitable parameters classified as topological, geometric, electronic were selected using a combination of stepwise multiple linear regression and genetic algorithm (GA-MLR) methods. The analysis of the results clarifies the notion that the artificial neural network (ANN) model shows superiority over the multiple linear regressions (MLR) by accounting 92.3% of the variances of antiseptic potency of the 2-phenylnaphthalene scaffolds. The accuracy of 8-4-1 basic back propagation (BBP) ANN model was illustrated using leave-multiple-out (LMO) cross-validation. Moreover, the mean effect of descriptors shows that Pw2 is the most crucial parameter affecting the inhibitory behavior of ligands.

(LIQUID – LIQUID) EQUILIBRIA OF (WATER + LEVULINIC ACID + ESTERS) TERNARY SYSTEMS

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Levulinic acid, a carboxylic acid containing ketone structure, is a clear to brownish semi-solid melting at 310 K soluble in ethanol, ethyl ether and chloroform. Levulinic acid can be used as an acidulant in foods and beverages. It is used as an intermediate to manufacture synthetic fibbers, pharmaceuticals, pesticides, plastics, rubber, and synthetic fibbers, perfumery, food additives, fuel additives, herbicides, solder flux, stabilizers and printing inks. Levulinic acid and its esters are also used as plasticizers and solvents in polymer, textiles and coatings. Therefore, it is important to separate and purify levulinic acid [1].
The efficient separation of carboxylic acids from aqueous solutions is an important concept in the chemical and fermentation industries where many solvents have been tested to improve such recovery [2,3].
In this work, dimethyl succinate, dimethyl glutarate and dimethyl adipate are used as solvents in the separation of levulinic acid from water. Several studies have been carried out to present LLE data to extract levulinic acid from its aqueous solutions [4,5]. In this sense, we report the LLE results for the three ternary system, (water + levulinic acid + dimethyl succinate), (water + levulinic acid + dimethyl glutarate) and (water + levulinic acid + dimethyl adipate) at T= 298.15 K, for which no such data were available in the literature.
Levulinic acid, dimethyl succinate, dimethyl glutarate and dimethyl adipate were purchased from Merck and were purity of 0.98, 0.98, 0.99 and 0.99 in mass fraction, respectively. The chemicals were used without further purification. Deionised and redistilled water was used in all experiments.
Liquid-liquid equilibrium (LLE) data of the solubility (binodal) curves and tie-line end compositions were examined for mixtures of {(water (1) + levulinic acid (2) + dimethyl glutarate or dimethyl glutarate or dimethyl adipate (3)} at 298.15 K and 101.3±0.7 kPa. A type-1 LLE phase diagram was obtained for these ternary systems [6].
The reliability of the experimental tie-line data was confirmed by using the Othmer-Tobias correlation [7]. The LLE data of the ternary systems were predicted by UNIFAC method [8]. Distribution coefficients and separation factors were measured to evaluate the extracting capability of the solvents. Furthermore, LSER [9] model equations were presented to calculate distribution coefficients and separation factors.

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SIMULATION OF PRECIPITATION TITRATION OF IODIDE ION WITH SILVER NITRATE SOLUTION USING PH GLASS ELECTRODE

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Precipitation titration of halid ions by silver nitrate is generally carried out using classical methods or a silver electrode (potentiometry). In 2006 [1], it was predicted, through a computer simulation method, that the detection of the end point in the potentiometric titrations of bromide ion could also be achieved by using a common pH electrode in the presence of a weak acid, known as mediator, which produces a sharp change in pH at the end point. In the present work, the precipitation titration of iodide ion was studied with Payame titration software by using some mediators as an indicator. The important parameters in this new method are solubility products of analyte/silver nitrate (Ksp) and mediator/ silver nitrate (K´sp). The results of the method showed that like silver electrode, we can do the precipitation titration with a pH glass electrode with optimize the amount of mediator. Soudium hydrogen carbonate, soudium hydrogen bisolphite, and potassium hydrogen oxalate were studied as madiators. The results show that, using this method can help to obtain the amounts of iodide ion like as other potentiometry methods. This simple and easy new method can use in the all chemical laboratories.

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T7P23

STUDY OF CHEMICAL COMPOSITION OF ARTEMISIA HERBA (A PLANT TRADITIONALLY USED IN IRAN AS AN HERBAL MEDICINE) USING HYDRO DISTILLATION FOLLOWED BY GAS CHROMATOGRAPHY MASS SPECTROMETRY

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The aerial parts of the plant Artemisia herba were collected in May 2007 from Babaaman (North Khorassan Province of Iran). The plant was isolated by hydrodistillation. A total 61 constituents, representing more than 98% of the oil were identified by gas chromatograph/mass spectrometry(GC/MS). The main compounds, were alpha-pinene (3.28%), champhene(4.8%), sabinen(5.18%), beta-myrcene(3.04), cis,beta-terpineol(11.31%), camphor (6.11%), 8-hydroxylinalool(2.64%), L-4-terpineol (2.5%), alpha- therpineol(2.33%), myrtenol (3.27%), bornyl acetate (6.2%), alpha-terpinol acetate (3.06%), germacrene (2.06%), davanone (8.49%), trans-farnesol (4.27%), cis-fernesol (2.07%) and 1,3,dicyclopentyl cyclopentane (2.29%) . This herbal medicine traditionally uses as anti-infectious, anti- bacterial, emmenagogue , parasiticide, gastric tonic, digestive and stomachic in Iran.

OCCUPATIONAL HEALTH AND SAFETY IN CHEMISTRY EDUCATION AND APPLICATION TO ASBESTOS

Fatih YILMAZ, H.Cihangir TUĞSAVUL, Barbaros AKKURT, İrfan KIZILCIKLI

Asbestos is a fibrous mineral containing several magnesium, iron, calcium and sodium silicates. Its main minerals are serpentine asbestos, amphibole asbestos, amosite, actinolite, crocidolite and chrysolite. It is seen in white, gray, brown and green colors, fireproof and carcinogen substance when inhaled. Very tiny fibres occurring during extraction, handling and usage of asbestos are dangerous to human health. In industry, asbestos is used as heat-resistant materials, covering material for brakes, electric and heat isolation, filling and undercoating material for paper, rubber and plastics, primer for paints, chemical filters, diaphragm cells, cement filling material and construction material.
In Turkey, imported asbestos consumption is 30-40 thousand tons per year. Importing blue asbestos, once believed to be more dangerous than the others due to its fiber formation, has been approved in 1992. Asbestos is used in Turkish industry in cements, pipes and sheets, textiles, vinlex floor tiles and brake linings. The regulation about using asbestos in industry is arranged according to EU norms.
Education is one of the most important topics of developed and developing countries and it is regarded with much care. While the countries making their education systems in a good way and refreshing them in line with differing conditions of the time reach important positions in international areas, it is quite difficult to say that the countries unable to fulfill the same have gained the same situation.
We must be educated about occupational safety and health in our education life not only to avoid encountering occupational accidents and diseases in occupational life and workshops and laboratories, but also to cope with involuntary difficulties in our working places.
MEGEP prepared educational programs under the name of chemical technology, containing chemistry, paint production and application, tire production, petroleum-refinery, petroleum-petrochemistry, leather handling and chemical processes. Collaborations were made with universities and non-governmental organizations. Several questionnaires were applied in many provinces during sector scans and determining occupational proficiencies. As a result, the needs of chemical technology sector and demands from the educational program were determined. The educational program is based on occupational safety and health.
For engineering departments in universities, lectures about occupational safety in engineering educations must be included among compulsory subjects. After graduation, workplace engineering courses, specialist education and in-service trainings must be realized.
With this study, we aim to introduce the importance of occupational safety and health in chemistry education in relation to asbestos.

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WHAT WE KNOW ABOUT GENETICALLY MODIFIED (GM) FOODS

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Since Louis Pasteur's work, food science and technology has become a huge expansion on safety and availability of food. However, recent developments on biotechnology have increased safety of foods. Especially Genetically Modified (GM) corps has a big public concern mainly from environmental organizations. Since GM foods become part of our daily life, to create public awareness for this technology and potential risks of genetically modified foods are being important [1]. Biotechnology is a great area for students to understand the heredity, agriculture and critically evaluate the benefits and risks of this new technology. Promoting scientific literacy among all learners is a central goal of science education. Person who is scientifically literate on biotechnology can compare the processes of selective breeding and transgenic manipulation of plants, discuss the arguments for and against genetic modification of foods, describe the possible future impact of genetically modified foods, analyze public opinion about the use and safety of genetically modified foods [2].
Teachers are important role to help their students become a scientifically literate. Teachers' knowledge on biotechnology especially GM foods and GM medicines risks and benefits of these technologies associated with their use is important. Teachers should know how to teach biotechnology effectively in order to help students understand the subject and create an effective classroom environment. A teacher cannot be expected to teach what he/she does not understand. Therefore, educational programs should focus on improving science teachers' conceptions of the new technological development like as biotechnology with the anticipation that their own students knowledge on the issue would improve [3]. The lesson plans on biotechnology should focus on students' understanding on ethical issues, identification of GM foods in their diet, comparison of traditional methods of plant breeding and modern techniques of genetic engineering, identification of advantages and disadvantages to GM foods, and importance of responsible use of technology.
The aim of this study was to find out pre-service science teachers' conceptions on GM foods and their ideas on teaching and assessment strategies to help their students' understanding of these technologies. Seventy-one pre-service science teachers who enrolled İstanbul University Hasan Ali Yücel Faculty of Education, Department of Science Education voluntarily participated in the study. Seven open-ended questions asked pre-service science teachers to determine their perceptions of Genetically Modified foods in terms of media coverage, genetic pollution, environmental destruction and teaching methodologies of biotechnology issues as well as assessment strategies to use after and during the instruction. The data were analyzed using quantitative and qualitative methodologies. The result of this study showed that even most of the pre-service teachers believe to use traditional methodologies, some of them have more constructivist approach and new vision for teaching and assessing students' understanding the concepts.

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VANADIUM (V) COMPLEXES OF FUNCTIONALIZED CARBONIC ACIDS

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It has been found that the inhibitory or activating effect of Vanadium on many phospphohydrolases resides mainly on the (+5) Oxidation state. The similarity between the chemistries of vanadate (V) and phosphate is undoubtedly responsible for much of biological activity of Vanadium. Presence of Vanadium contains enzyme and biologically important system in (+5) oxidation state prompted us to synthesize vanadium(+5) complexes with bio relevant ligands to study their activity. All synthetical manipulations were performed under nitrogen atmosphere with the help of reflux condensor via grant joint, preparation, distillation were made by the standard procedures. Elemental analysis, IR spectal, UV-VIS and NMR spectal data have characterized the synthesized complexes. Electronic spectra of complexes displayed ligands to metal LMCT bands in the visible region associated with different transitions in the range(350-315nm and 200-190 nm) and related stereochemistry, quantum size particles properties related with and nanotechnology will be discussed in detail.

ELECTROCATALYTIC OXIDATION OF METHANOL ON PLATINUM NANO-PARTICLES ELECTRODEPOSITED INTO POLYANILINE/PALLADIUM/ALUMINUM ELECTRODE

B. Habibi, M.H. Pournaghi-Azar, H. Razmia, H. Abdolmohammad-Zadeha
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Recent developments in the preparation of micro- and nano-structured metal particles and their dispersion in porous materials have opened up the possibility of preparation of high performance electrocatalysts for technologically important reactions. Several procedures have been employed to prepare Pt supported nano-particles on different supports [1]. On the other hand, electrochemical deposition is an efficient method for the preparation of metal particles [2].

Conducting polymers such as polyaniline are useful supports for the immobilization of dispersed nano-particles of noble metal catalysts, due to the prevention of particle agglomeration. The porous structure and high surface area of many conducting polymers have led to their use as supporting materials in the development of new electrocatalytic materials. Due to the relative high electric conductivity of some polymers it is possible to transfer electrons through polymer chains, between the electrode and dispersed metal particles, where the electrocatalytic reaction occurs [3].

In this paper we report the electrosynthesis of polyaniline, PANI, on the pre-treated aluminum surface with Pd particles [4], characterization of the polymer coated electrode and preparation of a polymeric electrode by dispersing the Pt nano-particles in PANI as a matrix under potential step deposition. The resulting modified electrode (Al/Pd/PANI/Pt) was characterized by scanning electron microscopy (SEM) and cyclic voltammetry was used to evaluate the electroactivity with respect to the oxidation of methanol. The electrooxidation of methanol was studied in 0.1 M H2SO4 as supporting electrolyte. The effect of various factors such as amount of platinum incorporated, platinum incorporation method, thickness of the polymer film, concentration of methanol and medium temperature on the anodic current of methanol electrooxidation was studied and optimum value for each factor is suggested.

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CHEMISTRY TECHNOLOGY AND COOPERATION OF YOUTH ACHIEVEMENT EDUCATION FOUNDATION

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Education is a matter of principle concern and importance to which developed and developing countries show utmost diligence. While countries building their education system on a firm ground and refreshing such in accordance with changes through ages achieved a respectful place among world nations, same respect is far apart from countries which fell behind this achievement.

Education, particularly vocational and technical education, is deemed to be the most effective means of development in our country which makes progress to keep up with the contemporary civilization level and even pass beyond it, just as guided by the great leader Atatürk.

Chemistry as a secondary education branch was first introduced in M. Rüştü Uzel Chemistry Vocational School in 1946-1974. In line with developments in chemistry industry, over 10.000 students have education in Anatolian Vocational High Schools, Technical High Schools, Industrial Vocational High Schools and Multi-Program High Schools.

Besides Chemistry departments in Vocational and Technical Education, Rubber Technology, Plastic Technology, Process, Dying Technology, Leather Technology and Food Technology, which are prevailed to be widespread, will ensure considerable achievements in Vocational and Technical education.

Vocational Development course is one of the compulsory courses of Chemistry Technology Branch juts like in other branches. Entrepreneurship module is a module applied under this course. Acknowledgement of chemical production processes is not enough solely for achievements in business life. Each student has to comprehend required social and economic concepts to overcome this matter. By means of its applied programs aiming practice of the theoretical knowledge, Youth Success Education Foundation furnishes an opportunity to our students who receive Entrepreneurship module. We would like to share our acquirements from Youth success Companies of Kadırga Anatolian Vocational High School Technical High School and Industrial Vocational High School in 2007-2008 academic year.

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OCCUPATIONAL SAFETY AND ARSENIC IN VOCATIONAL EDUCATION

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Arsenic is used in various manners. The most stabilized one is metallic grey arsenic. When heated at 180 OC, this element transforms into arsenic oxide, oxidizes into arsenic acid with concentrated nitric acid (H3A5O4), dilute nitric acid and concentrated sulfuric acid compose arsenious acid (H3A5O3). Arsenic has +III, +V and –III values in arsenic composites. Arsenic halogenides having III value are toxic liquids, they are easily hydrolyzed.
Works, workshops, proceedings given below and similar places, and long-term cleaning and repair works in such business places causes suffering from effects of arsenic and arsenic compounds.
Elementary metallic arsenic is not toxic. The toxic ones are arsenic oxide of value III (As2O3 commonly known as “arsenic”), halogen arsenic compounds, particularly arsenic trichloride of value III (asCI3) and alkali arsenics depending to the solubility in the water and acid chlorhydric and thus their resorbability. Unlike common knowledge, arsenic is not an element more soluble in water but it is more soluble in hydrochloric acid.
Have profound effects when breathed. At first hand cramps and cough attacks are seen and then respiratory distress and chest pains occur and gastrointestinal and nervous distresses follow these effects.
This study will explain that below mentioned precautions will be taken for studies carried out in regards of arsenic and arsenic compounds for obtaining arsenic ore, melting the ore, obtaining arsenic and other compounds and alloys including arsenic, utilization of arsenic in chemistry industry, production an utilization of organic arsenic compounds.

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DEPOSITION, GROWTH PROCESSES AND CHARACTERIZATION OF POLY (DPHENYLAMINE- CO – ANILINE)

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Copolymerization of diphenylamine(DPA) with aniline (ANI) was carried out in aqueous sulfuric acid(1.7 M) by cyclic voltammetry. the copolymer film was grown on the surface of the working (carbon glass) electrode for various experimental conditions and the charge associated with film deposition was followed by cyclic voltammetry. The charge values were correlated to the amount of copolymer deposition (growth) and amaunt of copolymer deposited per unit time of electropolymerization (growth rate).

The kinetics of the electrochemical copolymerization was followed by deducing the growth and growth rate equations in terms of charge associated the deposition and the conditions of electropolymerization.The dedced growth and growth rate functions indicate the dependences of concentration of DPA and ANI. The films were obtained by electropolymerization in solution containing monomers in various ratio(0.0085 M DPA with 0.03-0.13 M ANI) and scan rate 25 mv/s between -0.1 – 0.9 V versus Hg/Hgcl2 electrode.copolymerization was found to be possible only at 0.0085 M DPA to 0.005M ANI ratio.The copolymer was also synthesized through oxidative polymerization via interfacial process in toluene and water mixture solvents with ammounium persulfate and hydrochloric acid at -0.2 – 0 °c .The films were characterized by cyclic voltmmetry, FT-IR spectroscopoy and conductivity measurements using four probe techniques.

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T8O01

TEACHING COLLEGE CHEMISTRY TO THE "YOUTUBE" GENERATION

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The world faces dramatic changes in the political, economic, social and environmental arena. These changes make effective transfer of information from an educator to college students even more crucial today in terms of preparing the current generation for the challenges ahead. Teaching chemistry to non-majors is always a challenge for educators due to lack of interest and motivation on students part.

This presentation will focus on my experiences in teaching a popular introductory chemistry course to non-majors at California University of Pennsylvania. The title of the course is "Chemistry for the Everyday World". Its main objective is to teach students the fundamentals of chemistry as they are applied to their own lives and the environment around them. A "green chemistry/environmental chemistry' approach is taken in conducting the course. The typical enrollment for this course is around 70 non-major undergraduates with fresmen and sophomore standing. The students have a veriety of backgrounds from several different disciplines, which makes it a challenge to keep them interested. My experience teaching this couse demonstrated that using multi-media resources and current popular culture significantly increases the level of interest and motivation by the students. Resources like "YouTube, Facebook, AIM, MSN", even plain internet and their relevant uses in the course keeps students engaged. In this talk, some of the strategies employed in teaching introductory college chemistry will be shared. Real data and examples will be used to demonstrate the effectiveness of teaching methods.

T8O02

STUDY OF ANALOGY APPLICATION ON EFFECTIVE TEACHING CHEMISTRY AT HIGH SCHOOL

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The motivational literature insists that conceptual change learning will only proceed when students are interested and engaged. Using analogue in teaching is one of the ways that turns teaching enjoyable and learning easy and exciting, beside encouraging creativity and ingenuity in pupils.
Because they enhance understanding by making connections between scientific concepts and the students' life-world experiences and by helping students visualize abstract ideas. Analogy is one of the most potent tools in the teacher's repertoire, and has been recognized as a common feature of science teaching. This article after a preview of using analogue history in teaching, mentions the specifications of a good and suitable analogue, and then states some examples of using analogues in teaching chemistry and its influence, and finally some recommendations to use analogues effectively in teaching chemistry for the teachers will be presented.

Keywords: Analogue; high school; chemistry; meaningful learning

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T8O03

AN ACTIVE LEARNING APPLICATION ON "ACIDS AND BASES": LEARNING ACHIEVEMENT AND ATTITUDES TOWARDS ACTIVE LEARNING

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In the recently years, science educators have focused on active learning to improve students' learning achievement and attitudes [1, 2, 3, 4]. In this study, it was aimed to investigate the effectiveness of active learning applications based on constructivism related to the Unit of "Acid and Bases", in the curriculum of high school chemistry, on 10th grade students' learning achievements and attitudes toward active learning. For this purpose, a new active learning material based on constructivism was developed by considering students' misconceptions and learning difficulties determined in the context of this research and also in the literature [5, 6, 7]. While developing the material, it was aimed to help students to construct the new knowledge by correlating with their existing conceptions, and to encourage students thinking, sharing ideas and discussing during the learning process. This new developed active learning material was validated by 4 chemistry educator and chemistry teachers, and then piloted with participation of 23 high school students to ensure its reliability. In this research based on active learning, pre-post test experimental design was used. The pre-test consisting of 25 items was developed by considering students' learning difficulties and misconceptions related to the basic concepts of "Acids and Bases" determined in the literature [8, 9, 10, 11]. The reliability coefficient of the pre-test was estimated as 0.81 (KR-20). The post-test consisting of 25 items was also developed to determine students' learning achievements about "Acids and Bases" by considering students' learning difficulties and misconceptions determined in the literature. The reliability coefficient (KR-20) of the test was found to be 0.79 after the pilot study. The new material was applied on forty-five 10th grade students attending in a high school in Turkey. Forty-five 10th grade students from two different classes were randomly assigned to experimental (N=21) and control (N= 24) groups. In the first step of the study, the pre-test was applied and no significantly difference was found between the groups ($F(1\text{-}43)=2.66$, $p>0.05$). Students' misconceptions and lack of knowledge determined in the pre-test were remedied with preparatory lesson. The instruction of the "Acid and Bases" was accomplished with active learning in the experimental group and with teacher-centred traditional approach in the control group. Before the instruction in the experimental group, students were informed about active learning process and then they randomly stratified to five heterogonous active learning groups.

After the instruction, the post-test was applied on both groups to determine their knowledge related to "Acids and Bases". The results showed that mean scores of the students in the experimental and control groups were 80.76 and 47.83 respectively and there was significantly difference between groups ($F(1\text{-}43)=102.529$; $p<0,05$). The results of Attitudes Toward Active Learning Scale, which was developed and validated in this study ($\alpha = 0.93$) indicated that students' positive beliefs about active learning were improved during the process ($F=79.81$, $p<0.05$). Results also showed that most of the students thought that active learning provided them to improve their motivations to study and research, chemistry achievements and relationships between friends, and they also became more self-confidence.

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T8O04

EXAMINING STUDENTS ACHIEVEMENTS AND BELIEFS DURING PROBLEM-BASED LEARNING APPLICATION IN "NEUTRALIZATION AND TITRATION"

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Over the last decades science educators have began to interest in active learning that challenges students to have the ability to learn, reason, think creatively and critically, make decisions, keep up-to-date in their field, and function as part of a team [1, 2, 3]. One of these active learning approaches is Problem based learning (PBL) which are based on the assumption that learning is a product of both cognitive and social interactions within a problem-centred environment [4, 5, 6]. The researches reflect PBL is more affective in chemical education as is the other science fields [7, 8, 9]. This study aimed to investigate the effectiveness of PBL related to the subjects of Neutralization and Titration in the context of "Acids and Bases" on university students' learning achievements, remedying of formation misconceptions and development of their beliefs about PBL. The PBL activities were developed in this study and reviewed by four chemistry educator for the validity. The activities were applied on 28 chemistry students attending second class in the education faculty for the reliability. At the beginning of the study, totally four classes from two different universities were randomly assigned to experimental (= 32, = 40) and control (= 26, = 38) groups. Before the instruction, a pre-test, which was developed in the study and determined validity and reliability, applied on students to identify misconceptions and misunderstanding related to the basic subjects to learn Neutralization and Titration. Results showed that there were no significantly differences between experimental and control groups ($p>0.05$). Students' misconceptions and lack of knowledge determined in the pre-test were remedied with preparatory lesson. The subjects of Neutralization and Titration were taught with PBL in the experimental and with traditional educational format in the control groups. Students in the experimental groups studied in their sub-groups that formed stratified randomly according to their mean scores in the pre-test and some abilities such as communication, using technology, leadership. After each of three PBL activities, PBL Assessment Scale, which were developed and determined validity and reliability, was used and individual interviews were conducted to determine the variations of students' beliefs. The results showed that the level of students' conscious about problem quality, students and instructor's roles increased significantly ($p<0.05$). Immediately after the instruction, the post-test, which were developed and determined validity and reliability, was applied on both experimental and control group students to determine their learning achievements and possible misconceptions about Neutralization and Titration. According to the results it was found there were significantly differences between the experimental and control groups and the number of students who had misconceptions in the PBL group was significantly lower than that of the control group.

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TEACHING THE CONCEPT OF ELECTRON IN SECONDARY SCHOOL CHEMISTRY

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The idea of an atom of electricity was introduced by Faraday and adopted by Helmholtz. In 1874, Stoney estimated its charge and named it electron. The experiments of Perrin (1895) and Thomson (1897), seemed to confirm the existence of the electron, but did not convince all scientists. In 1913, Bohr's atomic theory was received with enthusiasm by some physicists but with criticism by others. Nevertheless, the atomic structure of matter gradually won acceptance in reason of its extraordinary power in predicting spectral lines. Some years later, however, with De Broglie's and Schrodinger' works, the electron, from new paradigm becomes an old concept. The complete formulation of quantum mechanics, given by Dirac in 1925, and its interpretation by Bohr, justified that the electron was not a particle anymore. Remarkably, some of the founders of the quantum mechanics preserved a sceptical attitude toward this interpretation.

The teaching of the concept of electron in secondary school chemistry could be made easier and more interesting if it included a simplified historical approach of the development of the concept.

In this communication research results on how this subject was introduced through out the last century in chemistry text books will be presented, as well as a comparative analysis of different approaches.

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T8O06

FIRST-YEAR UNIVERSITY CHEMISTRY EDUCATION: A NEW ZEALAND CONTEXT

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A theoretical framework showing how the learning environment is shaped by the interplay between the teacher, the setting and the discipline will be presented. An analysis of the way in which these factors have influenced the instructional strategies adopted in a "traditional" first-year chemistry course at a large New Zealand university will be discussed.

T8O07

AN INVESTIGATION OF STUDENTS' VIEWS ABOUT THE EFFECTS OF COMPUTER BASED PUZZLES IN THEIR SCIENCE AND TECHNOLOGY LESSON

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The aim of science education is to educate individuals who have constructive, creative and critical thinking abilities, who apply the information and abilities gained from their educations to their lives and who understand the relation between science and technology [1]. Therefore, science education should provide opportunities for students to reach information themselves while they are learning, to analyze what they gained through learning activities, to benefit from such information by developing their creative abilities and to help them to reach the correct decisions. To keep the integrity of the topics and/or concepts, teachers want their students to understand, it is necessary for them to deal the concepts from all dimensions [2]. To reach such aim, instructional materials used for conceptual learning gain an extra importance, since the appropriate material use make such lessons more productive. Silbermen [3] reported that appropriate instructional material use increase students remembrance capacity 50%, students' participations to learning activities increase such capacity 70% and after completing an event or an assignment related to a participated activity, students remember 90% of what they gained during the application.
Thus, in this study, a series of computer based puzzles related to chemistry concepts in primary school science classes' level were developed to improve the effects of science teaching. Thus, the purpose of this study is to investigate students' views about the effects of the use of such puzzles in their science and technology lesson.
In this study, to prevent students to develop misconceptions and overcome the already developed ones, seven online puzzles related to chemistry concepts in primary school science education program were developed. They covered the all concepts in chemistry topics in primary school science classes, investigated in this study. Other than above concepts, to make students to understand important elements in the periodical table, a series of puzzles were prepared. After clicking the puzzles link, related to class level different number of puzzles is reached. After completing the puzzle, the button control the puzzle is clicked and then wrong answer turns to red and those true ones turns to blue. If the answer is half true and half false, then the true parts turns to blue and false part turns to red. So that mis-learning of the concepts is prohibited.
To determine students' views about the effects of computer based online puzzles in their science and technology lesson, at the end of the application of the prepared program, they are asked to give their views in a written form. After that, their written responses to such request were analyzed qualitatively.
At the end of the study it was identified that the developed computer based puzzles improved students' interests to science lesson. Some studies support our result in literature [4,5,6,7,8]. For example, Demircioglu [7] declared in his study with prospective social science teachers that using puzzles improved students' interests to the lesson. Similarly, Yanpar [8] stated that the use of puzzles improved students' performance.
Keywords: Computer Based Puzzle, Students' interests, Science

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T8O08

STUDENTS' OPINION ABOUT COMPUTER BASED PUZZLES EFFECTS IN SCIENCE EDUCATION

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Rapid development in technology lead society to live a life with full of knowledge, educational programs, therefore, prepared according to such expectations of the society, more and more investment take place to make such education possible, and educational policies are shape according to such aim. All institutions and everybody from all levels of the society and scientists are all agree that 21st century is going to be an information era. In such era, as scientist declare, super information highways, beaming an object by separating it to its atoms and transferring to another place, more and more globalization and other developments that people cannot even imagine today will be taken place[1]. Rapid development in information technology affects the structure of the education system and learning - teaching activities [2]. Technological developments affect the science education policy in Turkey and since 2005-2006 academic year the name of science course has changed to science and technology education. The aim of science education is to educate individuals who have constructive, creative and critical thinking abilities, who apply the information and abilities gained from their educations to their lives and who understand the relation between science and technology [3]. Therefore, science education should provide opportunities for students to reach information themselves while they are learning, to analyze what they gained through learning activities, to benefit from such information by developing their creative abilities and to help them to reach the correct decisions. To keep the integrity of the topics and/or concepts, teachers want their students to understand, it is necessary for them to deal the concepts from all dimensions [4]. In this study, five computer based puzzles were developed about; "matter", "mixture", "atom", "chemical bond" and "symbol of metal, nonmetal and noble gas". Thus, the purpose of this study is to investigate students' opinion about the computer based puzzles' effect in science education. Puzzles were developed to prevent students to develop misconceptions and overcome the already developed ones
After solving the puzzle, the button control the puzzle is clicked and then wrong answer turns to red and those true ones turns to blue. If the answer is half true and half false, then the true parts turns to blue and false part turns to red. To carry out students' opinion about the effects of puzzles, they are asked to give their views in a written form. At the end of the study it was identified that computer based puzzles improved students' interests to science lesson. Silay [5] (2002) reported that to overcome the monotonous characteristics of classrooms, to improve students' interests and participation to lesson puzzles, cartoons and educational games should be used. Similarly, Ozsevgec[6] (2006) reported that using alternative evaluation methods like educational games and puzzles attracted students' interests and effect students' learning positively.
Keywords: Computer Based Puzzle, Students' interests, Science Education

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T8O09

THE USE OF ADVANCED TECHNIQUES AND EXPERIMENTS IN UNDERGRADUTE PHYSICAL CHEMISTRY LABORATORIES

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In order to better prepare chemistry students to the rabidly advancing work and research environments, it was essential to perform a revision of the undergraduate physical chemistry laboratories in the department of chemistry at the University of Jordan. Several new experiments and techniques were introduced in the curricula of the physical chemistry laboratories. These include classical and dynamic NMR techniques, colloidal systems, self assembly and preparation and characterization of nanoparticles. In this presentation, the impact of such improvemtns on the teaching process, the involvement of the students in the "outside of the box" approaches and how the students dealt and developed their abilities in a chemistry lab will be discussed and evaluated.

T8O10

ANALYSIS OF HIGH SCHOOL SCIENCE STUDENTS' EPISTEMOLOGICAL BELIEFS ON THEIR CHEMISTRY ACHIEVEMENT

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The purpose of the study is to investigate the effect of high school science students' epistemological beliefs (EBs) on their chemistry achievement. Research questions:
- What is the contribution of students' EBs in predicting high school students' achievement in chemistry?
- What are the dimensions of EBs questionnaire?

Data are gathered from Epistemological Beliefs Questionnaire (EBQ) and students' last semester chemistry grades, including teacher prepared exams, quizzes, and participation in the class. EBQ was originally developed by Schommer (1990) and adopted into Turkish by Deryakulu and Büyüköztürk (2002). In this study, EBQ was adapted for measuring students' chemistry EBs by substituting "chemistry" word to EBQ. This instrument administered to 242 9th, 10th and 11th grade students of three different high schools in 20-30 minutes.
Data were analyzed using SPSS (Statistics Package for Social Sciences). Factor analysis was conducted for determining the constructs of the EBs and regression analysis was applied for the prediction of each construct's contribution on achievement. The results indicated that unlike previous studies including the original where the EBQ validated, the questionnaire having seven factors: the belief of learning is shaped by personal ability, learning ability is inherent, the belief of learning concerned on struggle, the belief of the existence of the single right answer, the belief of development of learning, certainty of knowledge, and belief of learning is concerned on external factors. The EBs significantly accounted for 9.5 % of the variation in students' achievement ($R= 0.308$, $F= 2.298$, $p < 0.05$). It was found that the belief of learning concerned on struggle and certainty of knowledge made a statistically significant contribution to the prediction of students' achievement ($p < 0.05$). Certainty of knowledge construct made the strongest reverse unique contribution to explaining the dependent variable, when the variance explained by all other variables in the model controlled. Thus, students who thought knowledge was certain appeared to get lower grades in chemistry. The reason of this could be teaching methods used in class such as lecturing, and so teachers should be careful about shaping students' beliefs. To eliminate this, students must actively seek out knowledge, acquire it, and construct it to obtain a deeper understanding of the concept [1]. Higher levels of students' belief about learning concerned on struggle were found to be associated with lower levels of achievement. Therefore, students who thought chemistry learning is related with their struggle appeared to obtain lower grades. Like previous studies, students having sophisticated EBs tend to get higher grades in chemistry. Otherwise, students who believe learning is related to their struggle and knowledge is certain get lower grades in chemistry. The results imply that science curricula should include the way of improving students' EBs for promoting students achievement. Students learn best when they derive the underlying ideas for themselves, other than material presented.

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DIFFERENCES IN 10TH GRADE STUDENTS MOTIVATIONAL ORIENTATIONS IN CHEMISTRY BY SCHOOL TYPE

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Academic motivation is an important construct in order to explain students' academic achievement. Motivated students engage in difficult tasks, expend higher effort, and persist even when they encounter with obstacles; as a result, they increase their achievement. Indeed, researchers propose a reciprocal relationship between motivation and performance; that is, motivation influences learning and performance and what students do and learn influence their motivation. Researchers propose different motivational theories in order to explain student motivation such as goal orientation theory [1], students' self efficacy beliefs [2], student's task value beliefs [3], attribution theory [4], and test anxiety [5].

This study aimed to investigate whether students attending different high schools differed in terms of their motivational orientations. The motivational constructs studied in this study were intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance, and test anxiety. Three hundred fifty four 10th grade students from different high schools (Anatolian High School vs. Regular High School) participated in the study. Motivation section of Motivated Strategies for Learning Questionnaire (MSLQ) was administered to the students to measure their motivational orientations. Confirmatory Factor Analysis was used to test factor validity of the scale. The maximum likelihood estimation method was used in LISREL analyses. The fit indices were found within acceptable limits ($\chi 2/df=3.49$, $GFI = 0.77$, $RMR= 0.07$). In addition, the Cronbach's Alpha for each subscale ranged from 0.54 for control of learning beliefs to 0.86 for self efficacy for learning and performance. Multivariate Analysis of Variance (MANOVA) was used, assigning six motivational constructs as dependent variable and school type as independent variable. Results revealed statistically significant difference between two school types on combined dependent variables (F (347,6)= 9,62, $p<0.05$, h2=.14; Wilks' Λ= .86). Univariate comparisons for the six motivational constructs revealed significant differences between two school types on intrinsic goal orientation, task value, control of learning beliefs and test anxiety. Students attending regular high schools were found to have higher mean scores on these constructs except for test anxiety.

In Turkey, in order to attend Anatolian high schools, students should pass an examination; as a result, these students are expected to have higher achievement than students in regular high schools. Accordingly, they are expected to possess higher motivation. Therefore, the findings of the study oppose to the results of previous research studies [6,7,8]. However, this study was conducted based on students' responses to self-report questionnaire; deeper investigation is needed to understand which factors affect students' motivational orientations by employing qualitative methodologies. Besides, this study focused more on the effects of school type on students motivational orientations in 10th grade level and chemistry course. Future studies should also examine how personal characteristics such as age and gender, or classroom context influence students motivation.

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T8O12

10TH GRADE STUDENTS' MOTIVATIONAL BELIEFS IN HIGH SCHOOL CHEMISTRY COURSE

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Cognitive approaches to academic motivation suggest that students' behaviors are influenced by their thinking and interpretation of external events. From this perspective, students are considered as active decision makers rather than passive respondents of external stimuli [1]. This perspective gave rise to the emergence of different theories aimed to explain academic motivation. One such theory is the Expectancy-Value Theory proposed by Eccles, Wigfield and their colleagues [2,3,4,5]. This theory predicts that students possessing high expectancy for success and holding positive value beliefs in the task tend to expend more effort, persist on the task against failure and not give up easily. Another theory which emphasizes cognitive involvement in the motivational processes is Attribution Theory proposed by Weiner [6]. Attribution theory seeks for causes of events (success/ failures) and their affect on future choices [7]. According to the theory, if students attribute the causes of events to internal and controllable causes; they will show more productive behaviors.
With respect to the related literature, the purpose of this qualitative research study is to identify 10th grade students' motivational beliefs in chemistry course based on "Attribution" and "Expectancy-Value" theories. The study was guided by the following questions: (a) what are the perceived causes of students' academic outcomes (failure/ success)? (b) What kind of reactions do students demonstrate to success/ failures? (c) What is the level of students' outcome expectations? (d) What kind of values do students hold? In the sampling process, first, a typical high school in Ankara, the capital of Turkey was selected. Then 10 students attending Chemistry courses were determined by consulting school administration. In order to find out students' motivational beliefs, semi-structured interviews were conducted. To analyze the data obtained from participants; the themes and codes were inferred from related literature before conducting the study. After the interviews, the data was transcribed. Then the codes were revised in view of the transcribed data by considering the research questions and the aim of the study. The themes are causal ascriptions for success, causal ascriptions for failure, behavioral consequents, psychological consequents, outcome expectations, and value beliefs.
The results indicated that all of the students stated more reasons for failure than for success. All of the students stated lack of effort as a main cause for failure; then task difficulty, difficulty in attention focusing, computational errors and not planning come. On the other hand, effort, teacher influence, content knowledge, strategic planning were cited as causes for success. Allocating effort as the main cause for failure and success has many benefits for students. Because they make attributions to internal and controllable causes, they can demonstrate more adaptive reactions to their academic outcomes. In addition, attribution of failure to mainly effort can be explained with another finding; all of the students valued chemistry course, and especially, utility and cost value were common among students. What is more, all of the students had high expectations for future careers, although some had low expectations for course grades.

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TEACHING ACIDS AND BASES IN SWEDISH UPPER SECONDARY SCHOOLS

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When new ideas are added to an existing scientific concept, models are changed and refined. A historical perspective illustrates the progress made in the scientific disciplines and their importance to society [1]. The area of acids and bases provides a good opportunity for teachers to discuss from a historical perspective the use of different models to explain phenomena. The historical scientific development of knowledge about acids and bases goes mainly from a phenomenological level to a particulate abstract level. Acid-base reactions can be described at the phenomenological level, using formula equations to represent reactions between substances, and at a particulate abstract level, using ionic equations to represent proton transfer reactions according to Brønsted's model. Acids and bases are, however, known to be difficult for students to understand [2]. Students' ideas are often a result of what is actively taught to them [3] and many students' "misconceptions" reported in the research literature could also be found in textbooks. Regarding acids and bases, research has shown that textbooks introduce new models in a non-problematic way and have a linear, cumulative view of models in this area. [4]. Research findings also show that teachers' knowledge of models in science in general and their use of these models vary [5]. However, there are very few studies on the way teachers understand and teach acids and bases [6].

Since the role of teachers is crucial in promoting student understanding, it is important to know how teachers teach acids and bases, and why. To contribute to this knowledge, this study investigated teachers' perceptions of: (i) their own teaching, (ii) their students' difficulties, and (iii) their use of textbooks, all in the context of acids and bases.

A questionnaire consisting of a Likert-type scale was developed, which focused on teachers' knowledge of different models, knowledge of students' difficulties, and use of textbooks, in their teaching of acids and bases. The questionnaire was administered to 441 upper secondary schools in Sweden, with a response rate of 42%, which includes 281 teachers. In a cluster analysis, three subgroups of teachers were identified. From each subgroup, two teachers were interviewed in order to enrich the data.

The results indicate that Swedish upper secondary chemistry teachers, on the whole, prefer to use the Brønsted model of acids and bases and think that the Brønsted model is clear for students. In cluster one (47% of the teachers), teachers' knowledge of how the Brønsted model differs from the Arrhenius model was limited and diverse, while teachers in clusters two (38%) and three (15%) were more aware of the differences between Brønsted and older models. However, only teachers in cluster three did explain the history of the development of knowledge about acids and bases in their teaching. Regarding the use of textbooks, teachers in cluster two (like the teachers in cluster one) relied more on the content in the textbooks than those in cluster three. The teachers' perceptions about students' difficulties were in accordance with findings reported in research, but there were no differences between the three clusters. Implications for chemistry teaching and education, and for further research, are discussed.

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T8O14

DEVELOPING TEACHING SEQUENCES FOR PH MEASUREMENTS BY GLASS ELECTRODE CELLS: IMPROVING UNDERGRADUATE STUDENTS' UNDERSTANDINGS OF NATURE OF SCIENCE THROUGH EXPLICIT ARGUMENTATION

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Acid/base systems are fundamental importance in many areas of chemistry and environmental science, however teaching of potentiometric pH measurement in chemistry courses is still problematic because the methods used to teach this topic have been insufficient and unsatisfactory for students. Additionally, recent studies in science education have proposed that instruction at every grade should pay more attention to teaching the nature of science (NOS) (1). Therefore, we argue that innovative teaching-learning sequences, in which basic theory and experiments related pH measurements are integrated with the new understandings about the NOS and teaching strategies are needed in the analytical chemistry laboratory curriculum (2). This study aims to: 1) extend and develop undergraduate students' understandings of content knowledge related to acid-base chemistry 2) develop instructional practice to promote students' appropriate nature of science views through argumentation strategies.

We attempt to create laboratories that are both instructive and interesting for students. For this reason we developed laboratory activities in which several important parameters such as acid-base standardizations and calibration parameters (Eo and slope) are measured and in which concepts of activity and ionic strength are considered and discussed (3). In the laboratory, the students also determined autoprotolysis equilibrium constants of water, pKw, in various ionic strength and temperature, and examined the change of the constant. They used the Gran procedure to linearize the data of the potentiometric titrations. The activities were structured in such a form that students' attention can be grabbed to how science works. While the students experience the activities, we tried to provide opportunities to them for participation in discussions and arguments about their claims and explanations. Furthermore, some argumentation activities in general frameworks such as competing theories-story, predict-observe-explain were designed and implemented in the teaching sequences. For this laboratory course, a text including, technical notes, student worksheets and the educational template contained the learning outcomes was created.

The innovative laboratory course that 10 chemistry students of sixth semester at Gazi University were participated in lasted for three weeks with four hours per week. In this case study, the students' conceptual achievements and NOS understandings were assessed by using mainly qualitative data sources including open-ended questions in written assessments, researcher's field notes and video records of interviews. Qualitative data were analyzed by using content analysis methodology at Hyperresearch Program. The results showed that the curricular materials and practices that we developed are effective on the students' conceptual achievements related to acid-base topic and understandings of NOS.

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T8O15

CHANGES IN THE LEAVING CERTIFICATE HIGHER LEVEL CHEMISTRY SYLLABUS, HAVE THEY BEEN REFLECTED IN THE ASSESSMENT?

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Assessment at both second and third level has come under immense scrutiny over the last decade with particular emphasis placed on the role it can play in student learning. Good assessment strategy should be preformed in such a way that is justifiable and allows all students to achieve their maximum potential [1]. Assessment should also reflect the stated objectives and leaning outcomes of a curriculum [2].
The revised Irish second level national syllabus (Leaving Certificate) in Chemistry was implemented in 2000 and first examined in 2002. The syllabus aims to:
- Stimulate and sustain student interest in and enjoyment of chemistry
- Encourage an appreciation of the scientific, social and economic, environmental and technological aspects of chemistry among others. [3]

This syllabus will be assessed in relation to its objectives which include:
- an ability to interpret experimental data and assess the accuracy of experimental results.
- an ability to organise chemical ideas and statements and write clearly about chemical concepts and theories. [3]

This new revised syllabus has received criticism due to the implementation of mandatory experiments without the proper equipping of all Irish Secondary and Vocational Schools, and also the failure of the terminal exam to provide adequate assessment for the shift in emphasis to the applied aspects of chemistry. [4,5]
The new syllabus is structured into thirteen examinable topics, nine core and four optional topics. The examination consists of two sections; section A containing three questions dealing with mandatory experiments completed by students during the course of their two years of study and section B containing seven questions which contain questions dealing with theory, applied aspects and applications of chemistry.
In this study, analysis has been completed on the last seven annual exams, with focus placed on the frequency of appearance of these particular topics in order to ascertain if there is a high level of predictability within the chemistry paper. Topics which haven't appeared on the last seven years, in either section A or B, also have been identified.
While there are issues in relation to the use of Blooms Taxonomy [6] in determining question type, in this study it is being used purely as a tool in order to compare the examination questions over a number of years.
Questions have been identified as knowledge, comprehension, application, analysis, synthesis or evaluation, and this has revealed that the predominant question type is of lower order with only a small percentage of higher order questions appearing in each examination.
Both the question type and frequency of appearance of keys areas and concepts of chemistry will be presented in this talk in an effort to identify or map out the trends in the examination.
Also as the Leaving Certificate Chemistry paper in 2008 has recently been completed in Ireland (05/06/08), an analysis of this paper will also be included in this study.

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T8O16

THE DEVELOPMENT AND EVALUATION OF SECOND LEVEL CHEMISTRY LESSONS, CENTRAL TO THE COGNITIVE ACCELERATION THROUGH SCIENCE EDUCATION METHODOLOGY

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Science education in Ireland has seen a number of changes in the last five years including the introduction of a revised primary and post-primary science curricula. These curricula have attempted to address issues in methodology, such as emphasising a constructivist approach, building-in practical work into assessment and promoting cognitive skills as a key to enhancing investigation, imagination and creativity [1,2]. There are however two separate science curricula for primary and lower secondary science levels and one aim of this study is to bridge these two curricula successfully.
The CASE (Cognitive Acceleration through Science Education) programme [3] was developed in the UK for this age group. The aim of the programme was to encourage higher level thinking, initially among 11-14 year olds, in order for them to better attain the objectives of the curriculum. [4] Numerous studies highlight the successful effects of the programme on students' higher order thinking [5,6]. In this longitudinal study the CASE programme was implemented and its effects were monitored across the primary and second levels in Ireland. The CASE programme was adapted and divided into two programmes suitable for use in the Irish system- namely Thinking Science 1 and Thinking Science 2. Thinking Science 1 was implemented with 398 primary level pupils (6th class- age 11-12) and 226 1st year second level students (age 12-13). The effectiveness of the programme on cognitive development was tested by the CSMS (Concepts in Secondary Mathematics and Science) tasks, assessing Piagetian levels [7]. The results of both programmes show increases in formal-operational thought. The core test results were analysed by residual gain score analysis, a method used to predict the post- test results for the experimental group as if he/she were part of the control group. Therefore, any great difference could be equated to the intervention programme. Some of these main finding were presented at the previous ECRICE conference in 2006 [8].
This work now concentrates on the development and implementation of second level chemistry lessons, central to the CASE methodology- Thinking Science through topics. Increasing the relevance and density of the use of the CASE methodology beyond stand-alone activities (suitable for use once every two weeks) to use within entire topics (from 5- 8 lessons over two weeks) demanded development of additional resources particularly in chemistry. Two chemistry topics on the Junior Certificate science course were chosen, materials and lessons were designed in accordance with the CASE methodology- to promote higher order thinking- and subsequently used by five teachers, trained in the use of the cognitive acceleration tools. The CSMS Science Reasoning tasks were used to test the effectiveness of the programme on the student's cognitive levels. Preliminary results from half of the cohort indicate that the cognitive levels of the experimental group were much greater than that of the control group, with mean residual gain scores of 4.24 and 0.34 respectively. Detailed results will be discussed at the ECRICE 2008 conference.

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T8O17

SELGGOG ABBEY – A CONTEXT LABORATORY PROBLEM FOR INTRODUCTORY UNDERGRADUATE CHEMISTRY

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Many authors have criticised the 'recipe' style chemistry laboratory as not providing a full learning experience and have made a case for the modification of laboratories tasks and the introduction of different teaching strategies including Context and Problem Based Learning (PBL) [,]. PBL is a strategy in which the 'problem' is the motivation for the learning experience, it is very much a student focused and directed strategy. The benefits from PBL reported include: retention of knowledge, development of transferable skills, problem solving, real world relevance, independence and increased motivation to name a few [ ].
PBL tasks should address curriculum objectives, be real and engaging, be 'fuzzy' and place the group in a professional role, i.e. as scientists. Students should be required to develop a problem solving strategy, to acquire new knowledge and to make judgements, approximations and deal with omitted/excess information [ ]. One of the main difficulties in using PBL in laboratories is the development of the problem (some examples are available [,]). It can be especially difficult to design problems when the students have limited background in the subject area and little experience of problem solving. In these situations the 'fuzzy' nature of the problem and the unstructured learning environment can be overwhelming for students and it can lead to student frustration and tutor difficulties in finding the balance between guiding the student and actually directing them.
This work provides an example of a PBL task that has been used successfully over the last two years in a first year undergraduate chemistry course as part of a redeveloped laboratory module that has been discussed previously [,]. The student cohort (approx 200 each year) taking the chemistry course was a heterogeneous group both in terms of previous chemistry experiences and degree programme.
The problem task developed involved groups of students (max size seven) working on behalf of an environmental protection agency who have been asked to determine the water quality in the rivers in a fictitious area called Selggog Abbey. Students were given some background information, a map of the region and some reports of illegal polluting practices being carried out. They were asked to (a) provide general information of the water quality (b) identify and quantify any pollutants present and their possible sources (if any) (c) discuss the implications of their findings and to make appropriate recommendations. The problem was implemented over a two week period after students had completed 15 laboratory sessions on inorganic and analytical chemistry. The completion of the task partly relied on students' being able to apply and transfer the skills and knowledge they had learned previously to solve this problem. The assessment of the task had 4 elements; (a) a prelab which included the students' planning and design of how to solve the problem, (b) in-lab questioning (c) a group report and (d) a presentation of their findings and recommendations.
Due to the nature of the problem, the exact scenario can easily be altered each year e.g. focussing towards particular analyses. Also each group of students had approx 7 members, the students had to organise themselves in advance of the laboratory sessions so that they could do all the laboratory work required. Evaluation of the task was carried out through surveys and interviews with both the students and tutors involved. Both were positive about the task, indeed many of the advantages of PBL were mentioned including, motivation,

consolidation of understanding, working independently to mention a few. Details of the problem and its evaluation will be presented.

LEARNING SPECTROSCOPY WITH COMPUTERS: THE NICE APPROACH

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Teaching students to deduce chemical structures from spectroscopic data presents significant practical problems. The theoretical basis of the method often lies beyond student's comprehension, and although theoretical models can be used to predict the spectra of simple compounds, the models have limited utility in the opposite direction, the determination of the structures from the spectra. This later operation is primarily empirical, and does not lend itself as well to a systematic approach. The ability to elucidate chemical structures from spectral data relies largely on implicit heuristics and experience gained from solving examples.
From our teaching experience,[1] we have identified the following learning goals:
<!--[if !supportLists]-->• <!--[endif]-->extract and describe the most significant data from each spectrum ;
<!--[if !supportLists]-->• <!--[endif]-->recognize typical spectral patterns associated with particular structural features ;
<!--[if !supportLists]-->• <!--[endif]-->state hypothesis and make logical deductions from data ;
<!--[if !supportLists]-->• <!--[endif]-->combine structural features to create a complete structure ;
<!--[if !supportLists]-->• <!--[endif]-->understand the limitations of each spectroscopic technique.

To promote self-study, we have designed and implemented a learning environment for trainees to gain experience in the analysis of spectra. In this presentation we will explain the approach that was adopted.
A collection of 100 cases has been carefully designed to cover most of the typical structure-spectra relationships in organics compounds. Each case presents four spectra: infrared, 1HNMR, 13CNMR and Mass spectra. No additional information is provided, except the percentage composition, which is given in selected cases.
In the first step, the student has to deduce the molar mass (using the mass spectrum), the organic functional groups (from the infrared spectrum), and the number of carbon and hydrogen atoms (NMR). From these data, the molecular formula of the compound is established. The functional groups are then confirmed, and finally, a structural formula is proposed. For this purpose, the different spectra have to be analyzed to consider all possible combinations. Each spectrum can be displayed in full screen mode by clicking on a zoom button. In this mode, resource material is available for each type of spectroscopy, similar to that available in typical reference books.
In this learning environment each answer is analysed. A wrong answer triggers an appropriate message to help the student understand the origin of the error. If an incorrect structural formula is chosen, the system explains the mismatch with the observed spectra, and describes the spectral features that should have been obtained from the proposed structure. If a correct answer is given, the student's knowledge is reinforced by presenting comments on each spectrum, and indicating the pieces of information that can be deduced from it.
A demonstration of this learning environment will be made during the congress.

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MOLECULAR SYMMETRY AND ART: ESCHER AND THE PALACE OF THE ALHAMBRA

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Learning molecular symmetry and group theory at an early time is important in order to be able to construct molecular orbitals, simplify Quantum- mechanical calculations and interpret molecular spectra. However those meeting it for the first time, find it problematic to grasp these concepts mainly due to their difficulties in understanding abstract mathematic formalism and to think in terms of the three- dimensions.
The presentation of symmetry elements and operations can be illustrated, at an advantage, specially from the pedagogical point of view, using some examples from other sources.
An introduction to molecular symmetry is done presenting first a historical concept of symmetry as well as examples of symmetry in nature, art and science:

- The evolution of the concept of symmetry with examples of some remarkable developments, like the study of crystals and electromagnetism
- The great variety of symmetry in nature, like the bilateral symmetry of mammals and insects, the continuous symmetry of round objects (solar and lunar disk) and their reproduction in ornamentation and in symbols.

As a good illustrative example, the work of the great graphic artist and research mathematician M. C. Escher is discussed in terms of elements and operations of symmetry. The drawings and prints of Escher give expression to these abstract concepts. His study of patterns of tiles of the beautiful Alhambra ,a 14th century palace in Granada, which had been built to serve as an administrative center for the Arab reign in Spain, led him to the concept of the regular division of the plane, contributing for the investigation of two-colour and multi-colour symmetry, a concept important for the development of crystallography, thus linking science and art.
Several images with the periodic drawings and prints from this artist are presented to illustrate the symmetry operations of proper and improper rotation (including inversion and reflexion) and their combinations.

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INTRODUCING A NEW ANALOGY FOR TEACHING OF PATH DEPENDENT AND STATE THERMODYNAMIC FUNCTIONS

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Thermodynamic have inevitable principles and regulations, which must apply motive for such inevitable, ambiguous and more pure principles by conducting extensive research in the field of physics and chemistry. One of the most powerful devices for transferring of this pure science in to clear and applied concept is utilizing the analogues. That is analogues would be one of the most powerful device in the field of teaching basic science, and utilizing as one general specification for teaching science. This research designing one set of principles and the method of analogues as aid for clearing the teaching method of thermodynamic learners to specify it correctly. In the next part of this research, path dependent and state functions have been analyzing by a simple analogue, to be used as guidance for thermodynamic abstract concepts teaching. Our results are shown the effect of this method on meaningful learning of students about path dependent or state thermodynamic functions.

Keywords: Analogue; science teaching; thermodynamic; path dependent functions and state functions

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T8P04

STUDY OF 3DMAX AND MACROMEDIA FLASH USAGE EFFECT ON LEARNING OF ELECTROCHEMICAL CONCEPTS AT HIGH SCHOOL

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Different software can be used to simplify the points in teaching electrochemistry, because teaching and learning through computer provides an opportunity in which learners are involved in interactive learning and would enjoy it. It is often difficult for high school learners to understand electrochemical concepts, that some misconceptions have been reported in this case. There is a usual method to understand electrochemical concepts; teaching through symbolic approach. In this article, we introduced a way of simplification with using animations which are made in flash media player and 3dmax to understanding the molecular world and then we examine three levels of learning; molecular, symbolic and laboratory learning in Janstone's view on teaching and learning electrochemical concepts and finally we will state some approaches to teach electrochemical concepts better based on computer based learning.

Keywords: Ectrochemistry teaching; interactive teaching; misconception; Animation; 3dmax; macromedia flash

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T8P05

INVESTIGATION THE IMPACTS OF WEB-BASED CHEMISTRY COURSES ON CHEMICAL LITERACY AMONG HIGH-SCHOOL STUDENTS

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Chemical literacy is a broad term that incorporates scientific ideas and chemical concepts, as well as scientific practices. Efforts to establish a theoretical definition for chemical literacy were conducted by Holman [1], Atkins [2], and more recently by Shwartz and co-workers [3]. These frameworks can be used to assess the attainment of the various components of chemical literacy through the domains of content, context, skills, and attitudes.
The goal of our study is applying of these frameworks to assess the attainment of the various components of chemical literacy among high-school students that used Web-based learning environments on chemistrycourses.
Barak and Dori [4] found that incorporating ICT into freshmen courses can enhance students understanding of chemical concepts, theories, and molecular structures. Another study showed that ICT-enhanced learning had a positive affect on students chemistry achievements, provided the students were actively engaged in these environments [5].
In this study, we attempt to assess the impacts of Web-based chemistry courses on chemical literacy among high-school students who studiedadvanced chemistry course (11-12th grade). This study was based on two theoretical frameworks: The role of Web-based learning environment in performance of learning unit [6], and the scale of levels of chemical literacy. The two chemistry courses Websites were similarly designed to facilitate knowledge sharing, and included administrative information (e.g. course syllabus and timetable), and course contents (e.g. PowerPoint presentations, problem sets and their solutions). Hyperlinks to enriching chemistry Websites, chemical e-journals and free molecules visualization software, were all included in the Websites. Factors, which may affect student's skills and attitude toward Web-based courses and investigation the chemical literacy, are to be examined according to the chemical literacy framework and assessment procedure.
The result of this study indicated that Web-based chemistry courses enhance chemical literacy among high-school students who studiedadvanced chemistry course (11-12th grade). The findings can be helpful in the process of designing new curricula, and emphasizing certain instructional strategies in order to foster chemical literacy.

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T8P06

DESIGNING AND ACCREDITING AN ICT- BASED EFFECTIVE MODEL FOR TEACHING AND LEARNING OF CHEMISTRY IN SECONDARY SCHOOLS

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For the past few years, there has been a growing understanding of the important role of information and communication technologies (ICT) in science education. Various new models of education are evolving in response to the new opportunities that are becoming available by integrating Web-based technologies. ICT can serve as a tool for designing new learning environments, integrating virtual models and creating learning communities. However, not all teachers are convinced that ICT should be an integral part of their teaching strategies [1]. Though ICT- based medium is considered to be commonly used, but lack of knowledge on how to utilize ICT for educational purpose were mentioned as barriers for ICT integration and ought to be further investigated.

The current study investigated and emphasized the effect of ICT- enhanced environments, as a tool for designing new educational area, on teaching and learning chemistry which seems challenging due to the complex and abstract nature of scientific concepts especially at a secondary school level. Helping students understand scientific ideas and chemical phenomena is the purpose of every chemistry instructor. One way of teaching for understanding is to have students engage in information processing and problem solving activities that focus on real-world experience, and daily-life chemistry. Another way is to employ visualization tools for enhancing conceptual understanding among students [2]. Information processing, Inquiry-based activities, project-based learning, problem solving and utilizing visualization can be done by integrating ICT into the curriculum.

The goal of current study was to explore the integration process of ICT into traditional teaching. The learning technologies were integrated to enhance inquiry-based learning, visualizations, and knowledge sharing. The current study investigated chemistry instructors' perceptions toward ICT and their activities while practicing the newly introduced technologies.

The result of this study indicated that according to existing limitations in the formal curriculum, it is necessary to pay serious attention to new approach which helps teaching and learning process and removes the educational shortages through providing virtual environment.

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T8P07

A MODEL FOR COMPUTER SUPPORTED CONTEXT-BASED CHEMISTRY TEACHING BASED ON ARCS MOTIVATION MODEL

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Motivation, an important quality that affects students' success in learning and performance, is one of the most important components of learning in any educational environment [1]. Although effectiveness of motivation on the learning and behaviour is known and accepted, but in general what does it mean and how will it be used in an instructional design are not known well. This is perhaps due to the difficulty of measuring motivation precisely. John M. Keller [2] proposed a motivation model, called ARCS Model, was one of the pioneering works in the area of motivational design, whose goal is to make instruction more appealing to the learner. Keller with his model desired to find more effective ways of understanding the major influences on the motivation to learn and for systematic ways of identifying and solving problems with learning motivation [3].
The ARCS model includes four major categories- Attention, Relevance, Confidence and Satisfaction- and each of these categories have three subcategories of motivational characteristics and the associated process questions for each subcategory. By themselves the categories do not guide an educator in how many and what types of motivational strategies to use or how to design them into the instruction. Thus, "motivational design," i.e., the use of the ARCS Model in an instructional design will help answer these questions [4].
The model provides a basis for prescribing motivational strategies or solving motivational problems to meet the individual motivational requirements of the situation, which eventually results in improving instruction so that it is appealing as well as effective and efficient. The ARCSmodel has been applied to areas such as courseware design, teacher training, multimedia production, science education, instructional message design, etc., so as to provide a set of sample motivational strategies for the designers working in those areas [5].
The aim of context-based teaching, an instructional design, is to increase the motivation of the learners by using real world contexts. The results of some studies about context-based learning have showed it had been positive effect on students' motivation. However, it is necessary to support the instructional design process with an accepted theory of motivation. Therefore, in this study ARCS model was accepted as the basis for context-based instructional design process. The aim of this study is to show how a chemistry context (cleaning materials) could be taught through computer-supported materials designed on the basis of ARCS model.
Keywords: Context-Based Teaching, ARCS Motivation Model, Chemistry

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T8P08

USING WORKSHEETS BASED ON 4E TEACHING MODEL DURING TEACHING

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A variety of instructional technologies are used during teaching learning activities. One of them is worksheets. The aim of this study is to determine students' misconceptions about the dynamic nature of chemical equilibrium and remedy their misconceptions with a worksheet designed according to the 4E teaching model.
In this research, a case study methodology was used. The study was carried out in the spring term of 2007-2008 academic year. The sample consists of 35 students at 10th grade from a high school located Trabzon. To collect the data the Dynamic Nature of Chemical Equilibrium Concept Test (DNCECT), a semi-structured interview and an observation procedure were used. The DNCECT was applied as a pre test. Then the subject was taught by using worksheet in classroom. The teacher applied the worksheet in a regular period of a lesson. During the instruction observations were performed. After two weeks, pre-test was applied as the post-test. Finally, semi structured interviews were conducted with eight students in that class. As a consequence of analysis; the worksheet designed according to the 4E teaching model affected positively in remediation of students' misconceptions about the dynamic equilibrium concepts. The research is ended with suggestions that similar worksheets should have been developed for different chemical equilibrium concepts and other chemical concepts, used to enhance teaching and learning process.

THE EFFECTS OF QUIDED INQUIRY INSTRUCTION UNIVERSITY STUDENTS' ACHIEVEMENT ON ACID AND BASES CONCEPTS

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It is a widely accepted fact by educators that inquiry is very important to reach new knowledge. The most important feature of this method is to enable both teachers and learners to be researchers, idea propagators and problem solvers. Furthermore, it has some positive consequences such as making students active, developing their understandings, improving their research skills and understandings of the nature of the science [1].
Although science teachers play an important role in the implementation of inquiry model, they face many difficulties during implementation in the inquiry instruction [2]. Cheung listed the obstacles emerged during the implementation of inquiry method in a study with chemistry teachers as follows: insufficient time, teachers' beliefs, scarcity of effective research materials, pedagogical problems, management problems, crowded classes, security issues, fear of encouraging students to misunderstandings, students' complaints, fear of assessment , scarcity of teaching materials etc[3]. The reason for this is the lack of methodological knowledge as well as scientific content [4]. According to Furtak , scientific teaching stands somewhere between the boundaries of the traditional method, in which certain answers known by the teachers are transferred to the students, and the open-ended inquiry method, in which students construct their own problems and problem solutions. This version is called guided inquiry method [5]. Guided inquiry could be defined as interacting with concrete materials to gain knowledge about some chemistry concepts by making use of the guidance made to a certain degree apart from the teacher in order to be able to solve a problem [6]. In guided inquiry method, teachers and learners play a crucial role in asking questions, developing answers and structuring of materials and cases. The usage of guided inquiry method is very important in transition from lecturing method to other teaching methods which are less and more clearly structured for alternative solutions.
The purpose of this study was to investigate the effects of guided inquiry instruction on university students' achievement of acid and bases concepts. The subject of this study consisted of 55 first year university students from two intact classes of a Chemistry Course instructed by the same teacher. One of the classes was randomly assigned as the experimental group and the other was assigned as the control group. Researcher prepared worksheets which were related to acid- based concepts based on guided inquiry instruction from [7]. The experimental group was cooperatively studied worksheets in the groups while the control group was individually studied worksheets in the class. Acid and Bases Achievement Test (ABAT) was administered to the experimental and the control groups as pre and post-tests to measure the students' understandings of acid and bases concepts. The results of analysis showed that students in the experimental group had better understanding of acid and bases concepts.

Key words: Open inquiry, quided inquiry, acid and bases

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T8P10

IMPROVING SCIENCE AND TECHNOLOGY/ CHEMISTRY EDUCATION ACHIEVEMENT USING MASTERY LEARNING MODEL

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Core idea of mastery learning can be concluded as aptitude is the length of time it takes a person to learn not how "bright" a person is, i.e., everyone can learn given the right circumstances. The chemistry/science and technology education programs aim reading and writing about science and technology for every student in primary school. If the educators have enough knowledge and instructional strategy about mastery learning model, this aim will become reality and almost every student can read and write about science and technology. The mastery-learning model is suitable for new science and technology education program, because, this new program aims to teach science and technology for every student in schools. Mastery learning model can be adapted and applied to the program easily. For this purpose, the educators should be trained about the application of mastery learning model to the program.

T8P11

AN EXPERIMENT FOR DEMONSTRATION OF SOLID-GAS PHASE TRANSITION

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Phase, phase diagrams, phase equilibrium and phase transitions are important concepts in physical chemistry. Students can not easily understand these concepts. The process of sublimation, which is a phase transition, is an interesting and impressive phenomenon [1]. One of the commonly used examples for teaching sublimation in physical chemistry is dry ice. Dry ice is solid carbon dioxide. It is commonly used as a versatile cooling agent. It sublimates by changing directly to a gas at atmospheric pressure. Its sublimation and deposition point is -78.5 °C. The low temperature and direct sublimation to a gas makes dry ice a very effective coolant, since it is colder than ice and leaves no moisture as it changes state.
In this study, an experiment for demonstration of solid-gas phase transition and the determined misconceptions about sublimation were presented. The use of chemical demonstrations as a teaching tool is rapidly gaining popularity in general chemistry classes. These demonstrations are believed to be a useful way to increase class attendance and interest in the subject [2]. In the experiment dry ice was produced from liquid carbon dioxide held under pressure in bulk storage vessel. To begin making dry ice, the liquid CO2, is sent through an expansion valve into an empty chamber where under normal atmospheric pressure it flashes into CO2 gas. This change from liquid to gas causes the temperature to decrease quickly. About half of the gas will freeze into dry ice snow.
A mixture was prepared from dye solution (10 mL, 300 ppm methylene blue), surfactant (10 mL, 300 ppm CTAB which is a cationic surfactant) and 150 mL water. A bit of dry ice was added to this mixture and the sublimation process was observed and recorded with a camera. The perceptions and misconceptions about sublimation were collected from prospective chemistry teachers by interviews.
As a result, it can be suggested the using of this experiment for the teaching of phase transition especially sublimation subject.

Keywords: Phase Transition, Sublimation, Dry Ice, Demonstration, Physical Chemistry

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THE EFFECT OF USING COMPUTER, MULTIMEDIA SYSTEM & FREE INQUIRY ON SCIENCE FACULTIES STUDENTS' FOR PRACTICAL CHEMISTRY LEARNING

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This study aimed to investigate the effect of using (Dry Lab) strategy on science students in acquiring science process skills compared with the traditional method (Wet Lab). This study attempted to investigate if there was any significant statistical differences ($\alpha = 0.05$) in acquiring science process skills among science students who were taught by using dry lab or wet lab method. The study society consisted of all students registered for general practical chemistry (106) and its size was (1321) students, while the study sample consisted of (142) students divided based on their request into two groups, experimental group consisted of (84) students and controlled group consisted of (58) students. The study result revealed that there were statistically significant differences ($\alpha = 0.05$) in acquiring science process skills due to the teaching strategy, these differences were in favor of using the dry lab as a teaching strategy.

A QUALITATIVE STUDY ON 10TH GRADE STUDENTS' EPISTEMOLOGICAL VIEWS AND LEARNING BELIEFS IN SCIENCE COURSES

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Epistemology deals with individuals' beliefs about the nature of knowledge and knowing [1]. Previous studies have shown that students' epistemological views effect or relate to the learning process and the ways knowledge is constructed in science classes. Students holding constructivist epistemological beliefs employ meaningful learning strategies and are active in their learning process; while students holding positivist epistemological views use rote memorization strategies [1,2,3,4]. With respect to the findings in the literature, the purpose of our qualitative research study was to identify what kind of epistemological views and learning beliefs students hold in science courses.

The study was conducted considering the following research questions: (a) what are the students' views about scientific epistemology? (b) What are the students' beliefs about learning and learning science? Ten 10th grade students from different classes in a public school in Ankara in Turkey participated in the present study. The data were collected through semi-structured interviews. The interview structure was adopted from an earlier study conducted by Tsai [5] in Taiwan. The interview questions included students' views about scientific epistemology, and their beliefs about learning and learning science. The interviews were conducted at the school in an empty room; each interview lasted about 20 - 45 minutes. A tape recorder was used during the interviews.

Students' responses to interview questions were evaluated on the positivist-constructivist continuum. Their epistemological views were aligned in three dimensions: (a) characteristics of scientific knowledge, (b) theory change, and (c) the role of cultural values and personal ideas in scientific explanations. On the other hand, learning beliefs were classified under five dimensions: (a) the learning environment in students' mind, (b) students' responsibilities in learning, (c) teachers' role, (d) students' motivational beliefs, (e) and the criteria used to evaluate success and failure. Before the study was conducted a codebook based on previous studies was created. Then, the interviews were transcribed, and coded. During the coding process some adjustments were made in the codebook in order to better accommodate the student responses by considering the research questions and the aim of the study.

The results indicated that majority of the students hold positivist epistemological views. On the other hand, students hold more constructivist views while explaining their beliefs about science learning; they could be classified as holding more constructivist views, holding more positivist ideas and expressing both views together. Indeed, the results did not support the coherence between students' epistemological views and beliefs about science learning. The way science courses implemented in the classrooms may cause this result: the teachers commonly use lecture methods, and evaluates their students based on short-answered questions requiring one correct answer and emphasizing memorization of given knowledge; the students do not experience open-inquiry or participate in discussions. To help students develop more constructivist epistemological views, science curricula should explicitly teach nature of science, and teachers should give importance to daily life applications in science teaching and promote argumentation through class discussions, scientific observations and experimentations.

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WHAT ARE THE FACTORS PREDICTING 9TH GRADE STUDENTS' CHEMISTRY ACHIEVEMENT?

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Science learning can not be explained only by examining cognitive factors; affective factors should also be considered. The affective domain includes constructs, such as attitudes, values, beliefs, opinions, interests, and motivation. Attitude is commonly defined as a predisposition to respond positively or negatively to things, people, places, events, or ideas [1]. A common intuitive belief among the individuals is 'attitude and achievement are positively related'. Many studies were conducted to verify this assumption. Indeed, several of them found that there was a positive low up to moderate correlation between attitude and achievement [2]. Motivation is the process of supporting goal-directed behavior [3]. Self-motivational beliefs are self-efficacy, outcome expectations, intrinsic interest and goal orientation [4]. Self efficacy is defined as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (p. 17). Self efficacy beliefs affect feelings, behaviors, thoughts and motivation of students. Outcome expectations are individual beliefs about the expected outcomes of events. Outcome expectations help students to decide on which actions are needed to attain the goals. Goal orientation is the individual's participation in learning environment [3]. Intrinsic interest and goal orientation are related to students' reasons and purposes for engaging in a task [5].
The main purpose of this study was to predict how well ninth grade students' attitudes, motivation and socio-economic status explain their chemistry achievement. 326 ninth grade students from two public high schools participated in this survey research. Students' ages ranged from 14 to 16 years old. The Motivated Strategies for Learning Questionnaire (MSLQ), Attitude Scale toward Chemistry (ASTC) and Chemistry Achievement Test (CAT) were used in order to collect the data. MSLQ is a self-report questionnaire developed by Pintrich, Smith, Garcia and McKeachi [6]. It was translated and adapted into Turkish by Sungur (2004). ASTC was developed by Geban et al. (1994) to measure students' attitudes toward chemistry as a school subject. CAT was developed by the researchers to measure students' chemistry achievement.
The data were analyzed by using factor analysis and multiple regression analysis. As a result of factor analysis six factors were obtained: self-efficacy, intrinsic goal orientation, extrinsic goal orientation, anxiety, control of learning beliefs, and socio-economic status. These six factors and the variable 'attitude' were used as independent variables, and students' chemistry achievement was used as dependent variable in multiple regression analysis. The multiple regression analysis indicated that socio-economic status, self efficacy, intrinsic goal orientation, and attitude explained 17% of the total variance of the chemistry achievement. Moreover, socio-economic status was found to be a good predictor of chemistry achievement.

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T8P15

DEVELOPING AND EXAMINING THE EFFECTS OF NATURE OF SCIENCE REFLECTION PROMPTS IN GENERAL CHEMISTRY LABORATORY

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Because of the empirical basis of scientific knowledge, laboratory work has long been a distinctive and indispensable component of science education. Currently it is widely accepted that, in the laboratory students should be given more opportunities for manipulating ideas instead of simply materials and procedures [1, 2]. Experiences with materials and procedures allow students to feel the phenomena being investigated, but we can not expect students develop the accepted scientific theories from these experiences spontaneously and easily. Additionally, these experiences can be used more fruitfully to make students reflect on scientific theories and nature of scientific knowledge [3].

These thoughts led us to modify the general chemistry laboratory instruction in our department. In order to challenge students' naive views about nature of science and help them to develop more informed views, we developed reflection on nature of science interventions in the form of reflection prompts such as reflection logs, "what if" probes, and scientific reasoning patterns. These reflection prompts aimed to call attention especially to the development and testing of scientific theories that deal with unobservable entities and processes (e.g., kinetic molecular theory, collision theory, electrolytic dissociation theory).

We examined the implementation of the designed reflection prompts with 42 students enrolled in general chemistry laboratory course. Throughout all laboratory lessons we used the reflection prompts whenever suitable. Using the reflection prompts we encouraged students to reflectively discuss about how collected data can be interpreted; what evidence means in science; interrelationship among experimental data, theoretical interpretation, justification and scientific knowledge; and development and testing of scientific theories that refer to unobservable entities and processes. In order to assess the effects of the reflection prompts on students' understandings about the development and testing of scientific knowledge, we used focus group interviews and students' written responses. Our purpose in this study is to introduce the designed reflection prompts and to present some preliminary findings about their effects on students' understandings about nature of scientific knowledge.

Analysis of collected data revealed notable developments in students' understandings about the empirical basis and testing of scientific knowledge. Most of them became aware of that scientific knowledge does not necessarily provide us with true representation of the world; scientific theories typically deal with unobservable entities and processes and cannot be directly tested by observation, instead scientific theories are tested by deducing from them observable consequences and then comparing these consequences with the results of observation and experiment.

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T8P16

THE IMPACT OF THE LMD SYSTEM ON THE TEACHING OF THE CHEMISTRY IN ALGERIA

Ali KHOUIDER
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During the last ten years, the number of students in the path Chemistry doesn't stop decreasing, because the path didn't offer a fan of formation in adequacy with the world of work.
The example of the chemistry faculty of the USTHB is for more than one reason edifying. Indeed, the number of students passed besides 600 students in 1998 to less of 150 in 2007, whereas the number of students in Algeria doubled frankly during this period.
The new reform introducing the LMD that started in 2005 already begins to carry its fruits, since the number of students in Chemistry left to the rise.
This thanks to a formation to the card permitting to cover the needs in chemists qualified with the socioeconomic sector.

AN OVERVIEW OF OXOTRANSFER REACTIONS IN BIOINORGANIC CHEMISTRY LECTURE

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Enzymes are biomolecules that catalyze chemical reactions and also one of the advanced topic in biochemistry lecture. Almost all processes in a biological cell need enzymes in order to occur at significant rates. Enzymes are known to catalyze about 4.000 biochemical reactions[1]. Chemistry of the mixed hard/soft nitrogen/sulfur chelating ligands bound to Mo at higher oxidation state is a field of current interest. Such studies did assume greater importance after the revealation that several oxido-reductases like DMSO reductase, xanthine oxidase and other oxo-transferases contain Mo(IV), Mo(V) and Mo(VI) as their prosthetic groups coordinated to nitrogen/sulpur donor points of a macromolecular ligand system[2]. High-valent molybdenum complexes which bear cis-MoO_2 units have attracted considerable interest due to their applications in catalytic oxotransfer reactions. Molybdenum is also necessary elements in diverse biological systems, since nature has made use of these metal centres in numerous redox enzymes[3]. In the important field of oxotransfer chemistry, numerous molybdenum complexes have been studied, especially as models for the active site of oxo transfer molybdoenzymes[4]. Oxygen atom transfer is a frequent reaction type in inorganic chemistry. For brevity, oxygen atom transfer reactions are signified as oxotransfer reactions[5]. Oxotransfer reactions, which combine biochemistry and inorganic chemistry researches have attracted considerable interest in the last decade. Oxotransfer reactions should be covered in bioinorganic chemistry course that attend chemistry students at universities.

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FACILITATING CONCEPTUAL CHANGE IN STATE OF MATTER AND SOLUBILITY CONCEPTS USING 5E INSTRUCTIONAL MODEL

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Discovering the reasons of why many students not being successful in learning chemistry has been the target of many studies. One of the possible answers stated as appropriate understandings of fundamental concepts that are evolved beginning of their studies are not constructed appropriately. Therefore, advanced concepts that build upon these fundamentals are not fully understood. In addition, as the students construct their own concepts, misconceptions which are stated as one of the obstacle in learning may arise [1]. One of the reasons of these difficulties can be stated as teachers do not take into account students' conceptions before the instruction. Moreover, it was showed that widely used traditional instruction is not sufficient for students to understand concepts deeply, to integrate students' ideas into coherent conceptual framework, to eliminate students' misconceptions [2]. One of the fundamental topics that affect students' subsequent learning in chemistry is the state of matter and solubility topics.

Bybee [3] stated that 5E instructional model was influenced by the works of German philosopher Johann Friedrich Herbart, in addition to that of John Dewey and also Jean Piaget. The modifications of this model such 3E, 4E, and 5E can be found in the related literature. 5E learning model is rooted its' fundamentals in constructivism and it facilitates conceptual change. The phases of 5E learning model are (1) engagement in which students are engaged to the learning task, (2) exploration in which students are exposed to activities to explore the ideas, (3) explanation in which the concepts, processes, or skills become plain, comprehensible, and clear, (4) elaboration in which further experiences exposed to students to extend, or elaborate, the concepts, processes, or skills, and (5) evaluation in which students find opportunity to evaluate their understanding.

The main aim of this study was to investigate the effectiveness of 5E Instructional model over traditionally designed chemistry instruction on students' understanding of state of matter and solubility concepts at 10th grade level. To examine the effect of the treatment on understanding these concepts, State of Matter and Solubility Concepts Test was developed. This test was prepared by examining students' misconceptions of state of matter and solubility from literature and interviews with the students.

In the traditional instruction, the teacher used discussion and lecture method and solved algorithmic problems to teach concepts. In the experimental group, 5E Instructional model in which demonstrations, hands-on activities, video animations were employed was used. This instruction activated students' misconceptions by presenting demonstrations, hands-on activities, video animations and questions that allow the misconceptions used to make prediction about the situation. Also, this instruction provided the evidence that typical misconceptions are incorrect and provided the correct explanation of the situation. The results showed that the 5E instructional model caused a significantly better acquisition of state of matter and solubility concepts and eliminated the misconceptions better than traditional instruction. Also, science process skills were a strong predictor for achievement related to state of matter and solubility concepts.

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BIOLOGICAL AND BIOCHEMICAL SCIENCES IN CHEMICAL ENGINEERING EDUCATION IN TURKEY

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Since early 1980s, integration of biotechnology and chemical engineering has emerged as an innovative field of chemical engineering, commonly known as "Biochemical Engineering" [1]. As biotechnology becomes one of the most promising technologies in the 21 st century. The chemical engineering profession is undergoing a rapid change from one based on petroleum, petrochemicals, and basic chemicals production and processing to one with much more emphasis on biology and biotechnology [1,2]. Furthermore, many chemical engineering students would like to specialize in biotechnology. With their solid grounding in chemistry, they can move easily into biochemistry, microbiology, and genetics 2. Chemical engineering departments have responded to these trends by adding various forms of biological nomenclature (e.g. Chemical and biological engineering in Koc University) to their names and integrating of new laboratory and lecture courses into the chemical engineering curriculum Adding biological coursework to chemical engineering curriculum has not been insignificant in Turkey. Many Chemical engineering departments have added a lot of biological course to their programs. In this work, we have investigated biological and biotechnological courseworks in curriculums of chemical engineering programs in Turkey. We determined many chemical engineering curriculums contain courses that directly or indirectly correlate with biology and biotechnology, such as introduction to biotechnology, introduction to biochemical engineering, molecular and cell biology. In Turkey, most common course in chemical engineering programs is biotechnology (e.g. Fırat, Hacettepe, Kocaeli, Osmangazi Universities). Hacettepe University, chemical engineering curriculum contains maximum number of Biotechnology courses. There are four different courses about biotechnology (Biotechnology I, II, III and general review of biotechnology)

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EXAMINING THE EFFECTS OF ARGUMENTATION-BASED TEACHING STRATEGIES ON SECONDARY TURKISH STUDENTS' UNDERSTANDINGS OF NATURE OF SCIENCE

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Kuhn stated that we should experience science as argumentation as well as science as exploration in order to understand the scientific thinking of scientists; students' scientific thinking can be developed best when they practice describing and justifying theories, presenting alternative theories, presenting counter-arguments, and providing rebuttals through argumentation with peers and teachers [1-2]. However, there is little research on what kind of function or models of explicit teaching strategies teachers' employ for student argumentation and how students' respond to those teaching strategies. In this study we tried to provide opportunities to 10th grade students' not only their engagement in authentic discussions and arguments about their claims and explanations on their conceptual understandings of gases topic but also talking about various aspects of nature of science (NOS). On this purpose we have developed instruction materials which initiate and promote argumentation process providing cognitive conflict with some examples of daily life situations, history of science, amazing events and giving different ideas and data which focused on common misconceptions of students about gases. In the design of teaching sequences various general frameworks such as competing theories-story, constructing an argument, predicting, observing, and explaining, designing an experiment were used, some examples of materials will be displayed at presentation[3].

In this case study, we acquired both qualitative and quantitative data from the course in which our explicit teaching strategies were applied; the course lasted for nine weeks with 26 students. Qualitative data sources of the study included audio and video records of interviews with participants, classroom activities and discourses; field notes; responses to open-ended questions; reflective journals and students' artifacts. Nature of Scientific Knowledge Scale was used as pre- and post-test to quantitatively assess participants' nature of science concepts [4].

The analysis of the data obtained revealed noteworthy development and changes in students' understandings of NOS. Most of the students demonstrated adequate understandings of the creative, developmental, unified and testable aspects of NOS. However, the students failed to explain amoral and parsimonious aspects of NOS.

It seems that our explicit teaching strategies based argumentation moved students towards more adequate understandings about NOS.

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A COMPARISON OF CONTEXT-BASED AND PROBLEM-BASED LEARNING

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It has been reported that Context-based approaches in which contexts and applications of science are used as the starting point for the development of scientific ideas [1]. However, Millar reported the idea that science teaching may start from applications and contexts has onlyreally come back into prominence since the 1970s [2]. Thus, the first systematic attempts to produce context-led teaching materials for secondary school science were Aikenhead and Fleming's Science: A way of knowing developed for use in schools in Saskatchewan in Canada [2].
Problem-based learning (PBL) is an active learning method based on the use of ill-structured problems as a stimulus for learning [3, 4]. Problem-based learning was initially designed for graduate medical school programs. The reason behind this was that young physicians were graduating with plenitude of information but without the critical reasoning skills to use that information wisely [5].Nevertheless, PBL has alsobeenadaptedforuse in elementaryandhigh schools [6].
Problem-based learning can be considered to be a subcategory of context based approach. In PBL, like context-based approach, instruction design is organized and driven by real life contexts and these contexts are presented in the form of problem scenarios. An important feature of PBL is that the problems or scenarios are encountered before all the relevant learning has taken place and act as the driver for new learning [7].
However, problem based learning method can be used in the instruction design of context based approach in which contexts and applications of science are used as the starting point for the development of scientific ideas. Therefore, from this point of view, both of them may be considered as similar. Besides, context based approach can be used together with other active learning methods.
The purpose of this study was to investigate the relationship between context based approach adopted in science curriculum design and problem- based learning used in science teaching.

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OPENING THE PORTAL TO SELF-REGULATED LEARNING: USING LEARNING LOGS TO DEVELOP METACOGNITIVE SKILLS

Bill Byers
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The past decade has seen considerable expansion in Higher Education as we move from the elitist approach of the past towards the mass education system that will be needed to support a future knowledge-based economy as envisaged by the ‘Lisbon Agenda’. This expansion however has not been accompanied by a proportionate increase in resources, leading to a decrease in both unit funding and staff to student ratios. Thus the time able to be spent on an individual student by members of academic teaching staff is also gradually decreasing. This has led to claims that, if standards are to be maintained, students must start to take more responsibility for their own learning.

The lecture will highlight a number of advantages to be gained by helping students to develop as self-regulated learners, including its importance to their employability, mobility and career development and will examine why this is currently not happening. Many students having been spoon-fed throughout secondary education, currently arrive at University highly teacher dependent and challenge averse, unprepared, unwilling and apparently unable to plan and control their own learning. Clearly if we are going to expect our students to take more responsibility for their own learning, we must be prepared to help them to make the difficult transition required to become independent learners. Although university lecturers will have made the transition for themselves it is by no means clear exactly how or when this was achieved; certainly not by surface learning to try to satisfy assessment criteria or by cutting and pasting from the web. Students must surely be encouraged to identify any weaknesses or gaps in their learning and then to confront rather than try to avoid them. The lecture will describe the work of the European Chemistry Thematic Network Working Group on ‘Developing Independent Learners in Chemistry’ which is currently examining the impact of a number of approaches, including, increasing motivation, peer group work, problem based learning, mentoring, the use of information sources including newspapers, metacognition, time management, reflective diaries, experiential learning, concept maps and IT on helping students to take more responsibility for their own learning and hence to becoming independent learners.

Work in progress on the use of ‘Learning Logs’, a weekly diary, to encourage students to reflect on their learning, to recognise what progress they are making with their studies, to pinpoint gaps or weaknesses in their knowledge and skills and to identify steps that they themselves need to take to make good such deficiencies will be described. Although the use of ‘reflective diaries’ by mature practitioners, particularly in the caring professions, is well known, here we are seeking to promote metacognition by encouraging, often immature students, to start to reflect on their learning. The results of student questionnaires will be used to indicate the benefits of this approach and to explore its potential to optimise the effectiveness of the learning support systems currently being developed by many universities.

"PICTURES OF AN EXHIBITION"- A POSSIBLE WAY TO MAKE CHEMISTRY MORE POPULAR

Nora RIDEG, Attila PAVLATH, Veronika NEMETH
????????????????*

It is plausible today that we are provided by means/tools, making our everyday life more comfortable and easier. The achievements of chemistry have been integrated into our everyday life indispensably. In spite of this fact chemistry does not receive popularity either in education or in publicity. There are two reasons for the unpleasant public judgment of chemistry: The negative criticisms in the broadcasting, and the scientists themselves, who are proud on their scientific achievements, but do not pay attention on the practical side of their results and on the public popularity of chemistry.

A further reason is the lack of basic knowledge. The chemistry education in primary and secondary schools should concentrate rather on quality issues instead of quantity. The learners may understand deeper how development of chemical knowledge and elaborating new techniques influenced the life of the human society and its role in the everyday life [1]. Furthermore, they would pay less attention on the critical news of the media.

The importance of demonstrating practical aspects of scientific achievements has been recognized in many countries. Accordingly, the colleagues at the American Chemical Society (ACS) compiled in 2002 the Power Point Show "Technological Milestones", demonstrating chemical inventions of the past 125 years [2] [3]. This Exhibition is divided into four basic topics and subunits, including medicine (27 subunits), communication (16), energy supply (20), and agriculture/ food safety (16).

We translated this slide show in our project into Hungarian. During translation we have realized that the original language usage of the show, though very interesting, exceeds the knowledge of the primary- and secondary school pupils as the targeted group. Therefore, with the permission of the authors, we changed the text from a methodological point of view. The adaptation of the exhibition material included, beyond translation, processing too, according to the European and Hungarian mentality, and didactical changes were introduced also. The didactical changes have made possible easier understanding without influencing the message of the original text.

In order to call attention of the readers, we illustrated the posters with 227 colour pictures, selected from a large set of collected illustrations, linking to the meaning of the texts. In contrast, the original exhibition material – except four posters – does not contain pictures. Therefore, the spectacular appearance of the posters seems suitable to catch the attention of the reader. The appearance of the posters is unique, although they differ in their colours.

The Exhibition is available in two versions: One consists of 33, 60x90 cm posters, framed in 70x100 cm size, and the other is available as a Power Point presentation electronically (If you want to get the presentation, please send e-mail to V. Nemeth: nemetv@chem.u-szeged.hu). All four topics consist of two additional posters, containing the table of contents and a chronology.

Booklets were prepared for lesson-processing of the Exhibition for the two targeted groups (primary- secondary-school pupils), according to the principles of museum-pedagogy [4]. The visitor's booklet helps understanding of the material of the Exhibition by carefully selected questions, and processing the information in frame of an extraordinary chemistry lesson.

The Exhibition was set out in several places in Hungary, and now we get an invitation from Kolozsvár, Romania. The Exhibition was translated into English, so now it can be offered worldwide. Our terminal goal with this exhibition is to present it in as many schools as possible, within and outside of Hungary in road shows to achieve the reputation of chemistry as a science and a subject.

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FRUITS OF WISDOM, AN EXPERIMENT IN COOPERATIVE LEARNING IN REGGIO EMELIA

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In a second class of the I.T.I.S. "L.Nobili" in Reggio Emilia chemistry is not the subject on the curriculum that attracts most interest of the students. The mixed ability students of this technical school were not very active in class. When acid base theory was discussed they had difficulty understanding the concepts.
To activate the students and help them understand acid-base theory better an educational design was made. In the design the context of the acid content of fruits was used, together with a number of cooperative learning activities. Fruit contains different types of organic acids, like citric acid, maleic acid, fumaric acid and oxalic acid. The amount of these acids can easily be determined by a simple titration. This way a link between theory and meaningful experience can be established.
The aim of this experiment was to determine whether the design was effective in alleviating the problems students had with acid-base theory.
The cooperative learning activities used were based on the work of Kagan [1]. During this study they used two cooperative learning activities developed earlier by Apotheker [3]. In order to increase the interest of the students the context of the acid content of fruit was used. Determining the acid content of different types of fruit is an easily obtainable and meaningful goal for the students. It makes the students aware of the practical usage of an educational subject in a daily-life context. In the design two separate lines were developed. In the practical line students learned to titrate, leading to the determination of the acid content of different types of fruit. In the theoretical line they learned about the theory of acids and bases, using their textbook (Bagatti etal,) [2].
The design was carried out in two consecutive years in class II^A at the I.T.I.S. "L.Nobili" in Reggio Emilia in Modena. The second year the design was modified, based on the evaluation of the first year's outcome.
The teacher and the students evaluated the design. The evaluation was based on the materials produced by the students. These included posters and PowerPoint presentations of the project and individual written tests. The teacher observed the work in the classroom and assessed the tests.
Happy students happy teacher
Both students and teacher are positive about the educational design. The posters and the presentations made by the students and the activities in the classroom demonstrate that the students were positively affected by the context. They worked actively with the Cooperative Learning tasks in a supportive environment.

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ASSESSMENT OF PRACTICAL WORK: A CROSS-EUROPE SNAPSHOT

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Practical work in chemistry is a resource-heavy activity with major demands made on finances, buildings, equipment, staff and students. Given the resource demands, one is entitled to ask whether practical work is successful in the sense of delivering the claimed learning outcomes. The starting point for this work is to investigate assessment methods. The scope is wider than the UK and compasses all of Europe with an eye to the harmonisation of tertiary level study under the Bologna agreement and the introduction of the Eurobachelor™ qualification. The aims of the study are to identify assessment methods, to follow mapping to claimed learning outcomes and to see how practical work is incorporated into overall assessment. From this study, it has been possible to compile a range of assessment methods providing exemplars of structure and assessment in practical activities. Useful reviews of recent literature in this area have been published by Johnstone and Al-Shuali [1] and also by Hofstein and Lunetta [2] and assessment in practical work is specifically addressed by Race [3]. Specific areas of practical work have been considered by Bennett [4, 5, 6, 7, 8, 9]

The study comprised three parts. Some 31 higher education institutions in 15 countries were identified for a preliminary questionnaire study which addressed questions such what is purpose of practical work, the time is devoted to practical activities, the style of activities, the methods of assessment and learning outcomes? On the basis of the responses, a more detailed questionnaire was developed which probed further and additionally looked into trends in practical work over the last decade. Evidence was returned from 20 institutions in 12 countries. In the third stage, in-depth telephone and face-to-face interviews provided insights into the reasons for the practical work culture in specific institutions.

General findings indicated that the reasons for and styles of practical work were not clearly justified. There was a significant element of inertia, ritual and a feeling with teachers that 'practical work is a good thing' without a solid underpinning reason. In only a few cases was there interaction with employers to inform practical work programmes. Often, there were no specific learning outcomes for practical work and, where they existed, they were not reflected in the assessment. Assessment was usually a write up of the laboratory session with, where applicable, credit given for quality of submitted sample. Nevertheless, there were examples of creative assessment linked to prelab and postlab. Overall, the time spent by students in the laboratory over the last decade has tended to decrease.

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EPISTEMIC VIEWS OF PHD GRADUATE SCIENTISTS AND THEIR IMPACT ON CHEMICAL EDUCATION

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Chemical education has been traditionally in line with academic science drawing on empiricism and logical positivism. Consequently university graduate scientists are trained on these premises. Relevant research has shown that there is a great appeal of the formative years on scientists' epistemic views. Such beliefs tend to be persistent and affect the way scientists teach, when they become science teachers [1]. Scientists experience a conflict as science teachers between their sense of the practice of science and their sense of what makes school different from the lab [2]. It has been argued convincingly that developing deeper understanding of nature of science (NOS) has a great impact on science courses [3]. Postgraduate educational/epistemological studies influence science teachers' perceptions and thus their instructional planning [4].
Reports from all over the world underline the problem of chemistry's lack of relevance to pupils' interests in secondary education. Several epistemic perspectives were proposed as a tool to analyse this problem [5]. The constructivist program was introduced in chemical education but its use was considered confusing [6]. There are interesting proposals that introductory chemistry courses would work better with a new philosophical basis incorporating synthetic scientific methods and a holistic-systemic-evolutionary-interdisciplinary approach [7].
A survey exploring the epistemic views of PhD graduate scientists –major in prior education in Chemistry or in Chemical Engineering- was conducted in Greece. The research was not addressed exclusively to educators but also to scientists professionally occupied outside the educational sector. The questionnaire comprised eleven statements attempting to delineate the core issues in science methodology/epistemology [8] i.e. the special status of scientific knowledge, induction, hypothetico-deduction, scientific methodology, relativism, succession of theories, utilitarianism/instrumentalism, reductionism/physicalism, emerging-supervening-dispositional properties and ontological or epistemological anti-reductionism. The respondents' beliefs were explored, in order to identify where convergence of aspects occurred, as the participants are essentially, even actually, the university tutors of the chemistry teachers in their undergraduate or postgraduate studies [9].
Only two items presented high degree of agreement: the special status of scientific knowledge and anti-reductionism. Relativism and other issues of constructivist epistemology like utilitarianism and instrumentalism had low degree of agreement. The acceptance of the positions concerning scientific methodology, succession of theories and emergentism was moderate, indicating a modest and critical scientific realism approach from the majority of the participants [10].
The significant inter-item correlations and the discrepancies among subgroups of participants with different background variables were also investigated. It was found that the respondents with postgraduate studies in the scientific subject presented significant differences from the respondents with postgraduate studies in education/epistemology in several cases. The effect of the kind of postgraduate studies in the views of scientists of the younger age range is

clearly manifested in the results, underlining the importance of the aspects moulded in the formative years.
Professional occupation, age, experience and career inside or outside the wide educational sector were also among the factors that influenced the research results.

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DEVELOPING TWO-TIER TEST RELATED TO CHEMICAL EQUILIBRIUM

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Many studies related to how students learn science concepts identified that student' misconceptions play a very important role on conceptual learning of science. Linked the results of these studies researcher have developed methods to explore students' misconceptions, for instance interviews, concept maps, POE, multiple choice tests and two tier tests (1,2,3,4,5). The aim of this study is to develop a two-tier concept test to determine students' misconceptions that students possess about chemical equilibrium. To develop the test for the data collection, similar studies were used to find appropriate questions.

The 19-item two-tier test, Chemical Equilibrium Concept Test (CECT), was designed. The CECT administered to 40 student teachers at 2nd grade from department of science and technology at Karadeniz Technical University in pilot study. The CECT was then administered to 70 students' at 11th grade from a high school in Trabzon.

The results showed that the Sperman Brown reliability for the CECT was found 0.94. It was determined that some of the students answered questions correctly but used erroneous reasoning and some other students had misconceptions related to the dynamic nature of chemical equilibrium, Le Chatelier Principle etc. As a result some suggestions were made to researchers and educators that they should have been encouraged to develop two-tier tests to explore students' misconceptions on basic chemical conceptions.

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A CASE OF ONE PROFESSOR'S TEACHING AND USE OF NATURE OF SCIENCE IN AN INTRODUCTORY CHEMISTRY COURSE

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This paper provides qualitative analysis of data that explores how one faculty teaches chemistry and nature of science (NOS) in his classroom. The study answers the following research question: how one chemistry faculty teaches about science and incorporates aspects of the history, philosophy and sociology of science into his introductory course? This study concentrates on one case to explore in greater detail what occurs inside an introductory level chemistry courses in one particular private higher institution in the Northeastern United States over one semester.

Participant's teaching style is presented through a combined and detailed memo of his classroom observations supported with examples from his classroom activities. The constant comparative approach (Glaster, 1992) was used in the process of organizing and analyzing the data. The findings revealed that the participant in this study preferred to use the traditional teacher-centered lecturing as his teaching style and whose main concern was to cover more content, develop the problem solving skills of his students, and who wanted to teach the fundamental principles of chemistry to students without paying special importance to the aspects of NOS in his instruction. The study also revealed that the critical role and possible influences of other variables of teaching science, such as drive to cover more content, large class size, lack of management and organizational skills, and instructors' concerns for students' abilities and motivation are more important then teaching for understanding of NOS.

STUDY OF UNDERGRADUATE CHEMISTRY EDUCATION IN IRAN

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The science of Chemistry has an old precedent in Iran. For more familiarity to this claim, it is enough that everyone knows that great primitive chemists such as Ebn-e-Sina (or Avicenna) [1-3], Jabir Ibn Haiyan [4,5] and Zakaryaye Razi [6-8] were living the major of their lives in the ancient Iran (that it is very larger from present Iran).
Furthermore, in recent years, not only there is high number of scientific entry records of Iranian chemists [9] and high station to Iranian chemists' papers, but also more than 90 percents of authoritative and international Iranian scientists are chemists.
Even so, in spite of this high scientific record in chemistry in Iran, this scientific improvement was not being accompanying with practical and industrial chemistry development in Iran. Industrial statistics shows that Iranian chemical and related industries have not have a progress proportional with scientific record increasing.
In this research, by gathering opinions of Iranian chemists and chemistry students and relevant data, we tried to found the reasons of this misfit without applying any prejudgment. Also beside and along this, the quantity and quality of theoretical and practical courses in undergraduate academic educations in Iran has been studied.
For reaching to our purpose, first various factors that can have effect on this problem has been considered, and then some questions was designed in questionnaire for founding opinions and reasons. The designed questionnaires were distributed between chemists and after their responses, were collected. These data was organized and analyzed to obtain the results. Finally, most important problems were extracted from analyzing data and there were sorted in their priority and importance for further using.
At last, it seems that this research, if is not enough and comprehensive for solving the problem, it can be a starting point for a series of systematic researches about the misfit of knowledge and industry in Iran. I hope that by planning the same researches with our study and by presenting of scientific method, in addition to the further improvement of chemistry knowledge, the quantity and quality of academic educations will be so better that it will cause the great improvement in Iran chemistry industries.

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STUDY OF STUDENTS' MENTAL IMAGES EFFECT ON LEARNING CHEMISTRY

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It is clear that use of images has effect on teaching the chemistry concepts. In classrooms, some examples which are used for simplifying and understanding the material better are in macroscopic dimension and students doesn't understand particles well such as atoms, molecules and ions. In order to help them understand these concepts in macroscopic dimension, illustration is used. In illustration, students can reflect different concepts of chemistry which have learnt during teaching. One of the illustration methods is to use painting art, so that one can determine the extent to which they have understood chemistry concepts and relationship among different areas of the sciences, society and technology by studying paints of these students.
Aim of this research is to determine through their paintings whether students have understood the taught concepts (such as chemistry, water, atmosphere, minerals, fuel) in chemistry of the first grade of high school in IRAN. After teaching the material, the students were asked to select a subject at their will and paint about it. This research has been performed in two separate cities in IRAN (Tehran and Shahrekord) but it has been implemented in equal age groups and it was specified that different place of residence had effect on selection of painting subject.
Our experience showed that use of this method led to deep learning in the students and provided the opportunity for them to express their beliefs in scientific concepts in their own way and language. On the other hand, teacher performs a kind of continual evaluation in this way and understands students' misunderstanding and tries to remove these errors before they increase to higher educational levels. This method is interesting for students so that most of them mentioned that painting the chemistry was new and interesting experience.

HOMEWORK ASSIGNMENTS IN CHEMISTRY LEARNING

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The paper presents the different homework assignments which contribute to the realization of the learning aims of the curricular contents.
Our working goal was to devise homework assignments that would enable:
revision and application of classroom knowledge on the examples from everyday life,
the application of the experimental skills acquired at school in everyday situations and with the equipment that usually exists in homes,
the development of the ability to find the ways how to solve tasks independently, plan and perform the necessary activities,
the development of the ability for planning and using time,
the development of personal responsibility and independence in task fulfilling,
the development of sense for cooperation, and
preparation for studying new contents.
We have planned homework assignments in accordance with the learning aims of a particular teaching content. Students are stimulated to do homework assignments regularly and responsibly by including the application of their results into the teaching/learning of new contents, and by providing opportunities to apply them in everyday life. Feedback information on the quality of the response and applied procedures, respect for students' evaluation of the task difficulty, and consideration of the reasons for non-fulfilling a task all contribute to the realization of the learning aims.
The planned students' activities included: problem analysis, action planning, selecting/assembling equipment, performing the experiment, measuring, data recording, and drawing conclusions. Students could perform the tasks individually, in pairs, or as a group work.
By presenting examples of the homework assignments for primary schools we hope to illustrate how students' divergent thinking can be stimulated, and how knowledge and skills, acquired in classroom can be applied to determine the properties of substances in everyday life.
The positive classroom experiences indicate that homework assignments enhance the development of students' abilities to apply knowledge and skills important for everyday life. The same assignment can be used to develop the ability to communicate with peers, parents and teachers.

THE EFFECT OF MEDIA NEWS ON CHEMSTRY EDUCATION

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The content of chemistry education involves all topics related to life and environment. These topics, as inseparable parts of chemistry education, are included in the primary curriculum as Life Sciences and Science; in Secondary Curriculum as Chemistry; and in Higher Education at the departments of Chemistry, Chemistry Engineering and Chemistry Education. The curricula of the departments, which study chemistry as minor, involve chemistry education. Consequently, all individuals, who receive multidisciplinary training, are more or less acquainted with chemistry. On the other hand, visual and published media focuses on a topic related to chemistry everyday and announce it to the public. The important outcomes could be listed as follows: the news in the media is related to the topics of chemistry and the interesting ones take place in media. However, the striking point here is the target audience in terms of level, reliability, processing and selection of the topics. In some case, the news in the media may have positive or negative effects on education. In the extent of the study attitudes of chemistry and social student groups who were exposed to media news related to chemistry towards mentioned news were compared with the usage of “Chemistry Education and Media Relationship Scale”. In the evaluation of the results, it was observed that chemistry students look at the news in the media more critical.

T9P06

CHARACTERIZATION OF HYDROGEN BONDING BY QUANTUM THEORY OF ATOMS IN MOLECULES (QTAIM)

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Hydrogen bond is a unique interaction whose importance is great in chemical and biochemical reactions including life processes. The importance of H-bonds is enormous. They are responsible for the structure and properties of water, an essential compound for life, as a solvent and in its various phases. Further, H-bonds also play a key role in determining the shapes, properties, and functions of biomolecules. There are new various theoretical methods to analyze different kinds of H-bonds. One of the most important tools often recently applied in studies on H-bonds is the ''Atoms in Molecules'' theory (AIM). It is worth mentioning the studies on the nature of H-bond interaction since the following questions arise very often: are the H-bonds electrostatic in nature according to the Pauling definition? What are differences between different kinds of H-bonds. Why very weak H-bonds are different in nature than the very strong ones? What are the differences between H-bond and van der Waals interactions from one side and covalent bonds from the other side? -1, 2-
In this manuscript, we have focused on applications of AIM theory to answer the above questions about the different types of H-bonded interaction. The power of AIM theory in explaining the unified picture of H-bonding interactions in various systems has been presented with examples including our recent work -3, 4-

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COMMUNICATING SCIENCE: CHEMISTRY IN THE CINEMA

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What is it that makes us lower our standards when visual media are concerned while, at the same time, we face the highest demands on texts? Teachers are still "geared" to the written word. They should remember that they face a young generation growing up with images, a generation learning to use computers much more quickly than their parents.
If we accept that some knowledge of science should be part of the education of every child, we need to think how best to provide that education. The problem of educational innovations in science education might be properly treated by analyzing the complexity on the basis of methodology of teaching [1].
On several occasions the possibilities of cinema and television as teaching instruments have been overestimated. It was thought, for instance, that the teacher could be miraculously replaced by an audiovisual. The enthusiasm for the language of images led some to believe that the transmission of ideas through audiovisual perception could take the place of verbal language. Many persons with conservative outlooks on teaching have prejudicially underestimated the rational use of audiovisual means by misrepresenting their functions and, not taking advantages of the real possibilities.
Movies are very popular for the youngsters, so here we report a movie analysis based on a vygostkian perspective about contextualizing the scientific contents [2]. First, we select some commercial movies looking for what we could take educational advantage of them. It is necessary a primary view focusing on the audiovisual language to realize if this movie are able to communicate with the audience.
We report a movie analysis of Erin Brockovich focused on the environmental problems. Nowadays we consider the environmental problems are a contemporary discussion, especially about Climate changes. So this movie is really an important cultural tool to contextualize and engage students to this scientific content that have a strong influence in our life.
We noticed on this movie analysis the potential of audiovisual, scientific and common languages to be used as a cultural tool to mediating science teaching and learning. Furthermore, the audience can learn values, information and knowledge present into the movie discourse and thus, the cinema shows the science in a society.
Integrating multiple reading, for example chemistry, biology and physics, in one movie, we can purpose to students to see beyond borders of their subjects, to understand the development of structures from these most simple up to the most complex and find integration viewpoints, therefore the solutions of this situation have to be searched for in the innovation of preparation of teachers of scientific subjects.

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CHEMISTRY TEACHERS KNOWLEDGE ABOUT EDUCATION OF THE DYSLEXIC PUPILS IN THE LIGHT OF RESEARCH

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The teacher's role in the contemporary school has changed as a result of modification of educational requirements as well as expections and predispositions of the learners. The teacher should be characterized by flexible style of work, changing and adjusting the contents to pupils' needs and interests. Applying various methods of work as well as didactic means he should bear in mind that there are various styles of learning, thinking as well as pupils personalities [1]. The teacher should create proper conditions for knowledge acquisition by all learners and provide support and understanding particularly for those who, despite efforts do not achieve expect results. This refers, among others, to the pupils who despite possessing good intellectual capability and intelligence over the average, reveal some difficulties in reading and writing thus having some problem with acquisition of basic knowledge in various subjects including chemistry. These specific difficulties in learning are termed as developmental dyslexia. 15% of pupils possess it. They have certificate from the psychological and educational clinic which the teacher should get familiar with. Dyslexic pupils can not make use of traditional lessons and despite hard work their school achievements are generally lower than those of dysfunction–free pupils [2]. As follows from the research dyslexic pupils have difficulties in writing and reading chemical reaction equations, total and structural formulae of chemical compounds. This is caused by difficulties in remembering and then reproducing chemical symbols, valency and proper use of large and small coefficients. Due to limited operation capacity memory they find it difficult to solve arithmetical tasks, to transform formulae and to converse units. Their difficulties in doing chemical experiments result from coordination disorder. Just these few examples show that they need education adjusted to their needs and possibilities to make the chemistry teaching-learning process effective [3,4].

To study chemistry teachers' knowledge about dyslexia as well as course and organization of dyslexic pupils' education some questionnaire research was carried out in junior and secondary schools, in Poland. The questionnaire included 38 open and closed questions. The thirty teachers participating in the research were chemistry graduates with the teaching experience from 5 to 20 years and high professional position. Thus this is pedagogically experienced group and theoretically well prepared for doing their job.

As follows from the obtained results all teachers possess theoretical knowledge about dyslexia. Most of them achieved it during the work at school and the others from media.

According to the teachers the positive features of the dyslexic pupils are reasonable thinking, unconventional ways of solving problems, curiosity, activity, big imagination and being brilliant. On the other hand, the negative features included: dissociation, calculation errors, lack of precision in doing tasks, difficulties coordination, poor visual and auditory memories. In the teachers' opinion dyslexic pupils' limitations making their effective chemistry learning difficult are: problems with remembering symbols, valencies, writing chemical formulae, reaction equations, taking into account large and small coefficients as well as mathematical tasks. However difficulties teachers come across in their work with dyslexic pupils are: unwillingness to learn and to read, to make an effort, lack of systematic work, chaotic work, frequent forgetfulness, lack of trust in the own potentiality as well as bad organization of time and work. The teachers being familiar with dyslexic pupils good and bad features should apply adequate methods of teaching and forms of work. Unfortunately, only few of them elaborated and use the own methods of work with the dyslexic pupils which mainly consist in making ball models by pupils, owing to which they model and then practise proper writing of chemical formulae and equations. They also use the multimedial board to practise difficult skills. Unfortunately these are very few and poor proposals. The disturbing fact is that most teachers do not apply individualization of teaching and the work with dyslexic pupils consists mainly in frequent check of writing correctness in their exercise-books, using different evaluation criteria and conducting extra activities. Teachers find it difficult to describe the effects obtained in chemical education of dyslexic pupils. They depend on individual predisositions, disorders and above all on the learning efforts pupils make. Some of them, even working systematically and spending much time, achive minimum knowledge while others achive very good results.

The obtained data are a source of information about difficulties teachers come across in the educational process with dyslexic pupils and about few ways they apply in the work with them. Teachers need and expect support and help to facilitate chemical education of dyslexic pupils as they are aware of their negligence in this area. The teachers' expectations are, among others, elaboration of tasks (workbooks) consolidating, suplementing and increasing knowledge which pupils could use at home, preparation of lesson scenarious taking into account various forms of work and didactic means suitable for dyslexic pupils as well as quidelines for their evaluation.

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T9P09

CHEMISTRY IS A LIVE AND FASCINATING SUBJECT

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Chemistry is a study of the composition structure and properties of substances, and the changes that they undergo. When we know the nature of air water, of rocks and metals, and of trees and of human beings, we are then in position to make other things which were not known before, such as plastics, penicillin, petroleum products and radioactive isotopes. Chemistry is closely related to the branches of modern sciences. Biology, the study of living things is based on principles of chemistry. Physics which is the study of the fundamental laws of nature depends in part on chemistry. Geology, or earth science, is founded on both chemistry and physics. So the science of chemistry represents central position among the other basic sciences. A different examples demonstrate that chemistry is a live and fascinating subject will be included [1-5].

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USE OF WORD ASSOCIATION TESTS IN CHEMICAL EDUCATION RESEARCH IN THE CLASSROOM – SOME EXAMPLES

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The Word Association Test (WAT) is a useful instrument that allows getting information about students' ideas about different concepts. Depending in the structure of the test used and of the type and depth of analysis undertaken, the information obtained can range from a simple quantitative overall picture representing the familiarity of students with a given topic to a more complete representation of students' ideas and misconceptions [1,2] .
Initially designed as a psychological/psychiatric instrument it gained some popularity in educational research as it is easy to apply even in a classroom situation and significant results can be obtained with a quick application and without a very long treatment of the student's replies.
The results of the application of the WAT may be very useful as a diagnostic tool, but also can give hints about learning outcomes after the study of a thematic unit or even a project work, which is usually much more difficult to evaluate. They can be used by teachers, not only as diagnostic/ evaluation instruments but also as a means to undertake some research in their own classrooms [3], as the application and analysis are not very much time consuming and do not interfere with the normal course of the classes.
In this communication we present the results of the application of WATs in different situations and contexts, at different grades. The topics under research were acid-base reactions (11th grade), energy (8th grade- professional), and environmental education – solid urban residues (10th grade) [4, 5 and 6]. The tests were used before and after the teaching of the relevant thematic modules, and a simple quantitative analysis showed increase in the number of valid associations, and a qualitative analysis allowed getting more information on teaching outcomes.

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A DESCRIPTIVE WEBLIOGRAPHY OF CHEMISTRY LECTURE DEMONSTRATIONS

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Though there is a great deal of valuable information about science education available through internet, using existing search techniques and procedures for retrieval through existing search-engines is not so efficient. These resources need to be organized for more efficient accessibility and retrieval. I have coined the word webliography, derived from web+bibliography, for the systematic listing and description of works published on internet on a given subject.
In this study, for an illustrative instance, I have compiled a webliography of Chemistry Lecture Demonstrations- my main research topic- containing 1738 entries. An example entry follows.
QD43: DNPO - a Chemiluminescent Rainbow (Chemiluminescence of oxalate esters) (887 words), photos(128×96 pixels), video(92 seconds), references□ February 15, 2008: last update July 2, 2003□ http://www.chem.leeds.ac.uk/delights/texts/expt_26.html.
As seen in this example, the structure of a webliographic record is as follows.
Library of Congress classification code for the subject[chemistry demonstration]: Title(size), images(resolution), videos(duration), references□ Date of accessing the document for cataloging: date of last update when cataloging □ Direct access address.
Of necessity, the format proposed and used is somewhat different from that of bibliography of printed materials. This article includes brief simple practical guidelines for webliographic description of online chemistry resources.
It is proposed that all chemistry sites prepare the webliographic records of their documents and store them in a WorldWide catalog accessible to students and researchers.

THE RELATION AND NATURE OF CHEMICAL KNOWLEDGE AND CHEMICAL EDUCATION

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Half century ago, Joseph Schwab had argued that science teaching should nurture themes that characterise a science as a distinct way of knowing [1].While Schwab's insight on significant goals for science education has been recognised and promoted [2], several decades later overwhelming evidence suggests that science education is not doing enough to align science teaching with contemporary perspectives in philosophy of science. Despite numerous international reform efforts [3], science teaching continues to reinforce a 'rhetoric of conclusions' [4],a traditionthat perpetuates the learning of conceptual outcomes while neglecting the learning of strategies that enable knowledge growth in different fields of scientific inquiry. For instance, in terms of a contrast of physics and chemistry, school science makes little differentiation beyond the obvious conceptual variation between the disciplines. Whereas the tendency in physics is mathematisation, chemistry relies on classification schemes such as chemical models which explain more the qualitative aspects of matter [5], Such treatment of science in schooling fails to communicate to students those disciplinary emphases which might play an important role in the processes of inquiry as well as knowledge growth. In this paper we investigate how the teaching and learning of chemistry can be improved through an understanding of the structure of chemical knowledge. We use arguments from the emerging field of philosophy of chemistry to highlight the significance of domain-specificity in the characterisation of science. our thesis is in contrast to educational research that promotes the improvement of chemistry teaching through an emphasis on, for instance, problem solving, concept learning and learning of science-process skills .In particular, we advance the position that the exclusion of philosophical perspectives in chemistry education is a significant deficit which hinders the teaching and learning of the nature of chemical knowledge. We believe that the application of themes from philosophy of chemistry will begin to address this deficit and enhance effective teaching and learning of chemistry. we argue that chemistry education will benefit from discussions that detail the nature of chemical knowledge. In this article, we will consider the ramifications of our discussion for theories of learning, curriculum design and teacher education.

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THE TEST ITEMS OF THE FINNISH MATRICULATION EXAMINATION IN CHEMISTRY

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Matriculation Examination has been the dominant summative assessment tool in Finnish upper secondary schools over the past century. It's based on the learning objectives and contents defined in the National Curriculum [1]. In general, the Finnish Matriculation Examination consists of at least four tests in different subjects. Candidates have an opportunity to include chemistry test into his or her examination but it isn't compulsory. The chemistry tests of the Finnish Matriculation Examination are entirely paper-and-pencil tests. Practical laboratory work is not included in the tests.

Summative assessment in chemistry is summarising and reviewing assessment that gives an overview of previous learning. It's usually practised at the end of the course or study module. [e.g. 2, 3, 4] Summative chemistry tests may include various kinds of test items. Generally, test items can be divided into objective test items and performance assessments [3]. Short-answer, true-false and multiple-choice items are the most typical examples of objective test items. Essay questions, calculative problems and laboratory tasks are common tools of performance-based assessment. [e.g. 3]

The objective of this study was to investigate what kind of test items are contained in the chemistry tests of the Finnish Matriculation Examination during 1996-2006. The research method of the study was a theory-based content analysis. According to the preliminary results of the study, the chemistry tests of the years 1996-2006 contain a wide variety of both objective and performance-based test items and their different combinations. The typical test items, according to the study, are short-answer and essay items. Calculative problems are also included in each test. The tests don't contain actual laboratory work but each test, however, includes a "written" task that measures the knowledge of common laboratory methods. The results of this study are represented in more detail in the poster presentation.

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CONCEPT OF ATOMIC ORBITALS

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It is found to be that the high school students had inefficient information and misconceptions on the topics of orbitals and theirs shapes because many high school textbooks in our country limit their treatment of orbitals concepts. The treatment of orbitals is usually brief and not well appreciated by students. In these textbooks, method of depicting orbitals is to draw graphs of the angular factors in wave functions. Some texts say these give the shapes of orbitals, which is wrong. The shape of an orbital is defined as a surface of constant probability density electron.
We have drawn these graphs for different orbitals using Mathematica program.

AN INVESTIGATION INTO THE EFFECTIVENESS OF CONCEPT MAP-BASED LEARNING IN A CHEMISTRY COURSE

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The aim of this study was to investigate the effectiveness of concept map-based learning (CMB) approach in a chemistry course. This research has been done in Ghom town, Iran. This research designed a new creative teaching method for the atomic structure mental concepts at the second high school chemistry course which was based on concept map. The concept map usage effects on developing of meaningful learning were studied. The design of this study was four groups pre-test–post-test (Salomon's design). The results suggest that the CMB approach promoted high levels of bloom's taxonomy in the learning process including analysis, synthesis, and evaluation. In other word our results showed the meaningful learning frontier is taken place from the application level above in the bloom's taxonomy. The output of data analysis shows there was meaningful difference between the scores of experiment and control groups of students with using concept maps by the students. This object was observed between the score of boys and girls groups, too. Our results and others in this area were indicated active and affective teaching-learning's condition process, so that it leads us to attempt in order to develop this approach in a large scale in educational system of our country.

T9P16

INVESTIGATION ON PREPARED RELATION WITH EVERDAY LIFE MATERIALS OF EFFECTIVENESS OF STUDENTS' UNDERSTANDING LEVEL ABOUT "MATTERS OF DENSITY PHASES"

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Basic concept are important for teaching students in science education. matters of density phases are one of the difficult subject of students undersanding. So; it is important that this concepts are linked with every day life.

In this study; student's understanding level about "matters of density phases" aimed to determine with ten open ended guestions which connected everday life. Besides; the reason of responses were wanted from students. In this investigation guasi-experiment method were used. Datas were analyzed by using t test. After analyzing data it is found that experiment gruop is more meaningful than control gruop. It is attended that every day life examples should be attractive for students and students' congnitive schemes can be widen with this examples. It is recommended that lessons should have been carred out with matterials which students can be applied on different conditions. In this context; subjects should have been given with reason conclusion while every day life linked with subject. Moreover; it will support students understanding that developed matterials are cary out for studensts understanding relationship between concepts.

REACH AND CHEMISTRY EDUCATION

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REACH is an EU regulation, which compiles many laws about chemical materials under a single roof in European Union. REACH means Registration Evaluation, Authorization and Restriction of Chemicals. REACH regulation, which was adopted by European Parliament in December 18, 2006 and came into force in June 1, 2007, was published in December 30, 2006 dated and L396 numbered copy of EU Official Gazette and its final revision was published in May 29, 2007 dated and L136 numbered copy. According to aforementioned regulation, firms, displaying activity and manufacturing or importing chemical materials more than one ton in a year in EU member countries, are not obliged to register aforementioned chemical materials into a central database under Management of European Chemical Agency, which takes place within EU organization.
REACH affects our requirement of chemical material of Turkey to EU directly! REACH aims to protect Human health and environment in the upper level. It shall be had more information about chemical materials and these information shall be shared with the society. Important matters, which should be known about REACH; REACH System has 4 fundamental steps such as Registration, Evaluation, Authorization, Restriction. Using and/or putting some chemical materials on EU market ay be restricted as a result of evaluation to be made by ECHA or forbidden completely.
REACH system affects our chemical material exportation into EU directly. For exportation of chemical material from Turkey to EU, our exporter firms are obliged to register the products to be exported, into European Chemical Agency (ECHA) as required by REACH system. As Turkey is not EU member yet, REACH system does not have effect on our domestic chemistry production and our exportation into non EU countries directly in the short period. In case our country is a full member of EU, regulations under REACH shall be obliged to be applied in all production activities of our chemistry sector.
Training programs are prepared in the branches of chemistry, dye production and application, rubber production, petrol – refinery, petrol –petrochemistry, leather processing, chemistry process in Chemistry Technology field within works of MEGEP. It is cooperated with specialists from universities and non governmental organizations during development of program. Many questionnaires are applied in many provinces during determination of occupational competence and sector research. As a result of such questionnaires, requirements of Chemistry Technology sector and their expectations from the program are determined in the generality of Turkey. These requirements constitute the base of program works.

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NINTH DEVELOPMENT PLAN AND CHEMISTRY EDUCATION

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Ninth development plan (2007-2013) was adopted in June 28, 2006 by Turkish Grand National Assembly. Plan is a basic strategy document, which puts development efforts of Turkey into an integrated frame in the period, when opportunities and risks are increasing for individuals, institutions and nations, in which globalization are effective in each field. It is important for the welfare of the society because of contributions of Chemistry Industry into the life and indispensable chemicals for production of other sectors.

Chemistry Industry affects daily life directly and is an industrial branch, which increases our life standards, provides protection against diseases and treatment, and contributes in cleaning and hygiene subjects; covers dressing and nutrition requirements of mankind and also provides input for other sectors and it is an indispensable sector, which contributes life substantially.

ISIC, which is prepared by United Nations, is used commonly in the activity scope of Chemistry sector in the worldwide. Furthermore, NACE is used in EU and there are joint works for ISIC and NACE.

Chemistry Education should also be planned and carried out accordingly. For this purpose, training programs are prepared in the branches of chemistry, dye production and application, rubber production, petrol – refinery, petrol –petrochemistry, leather processing, chemistry process in Chemistry Technology field within works of MEGEP. It is cooperated with specialists from universities and non governmental organizations during development of program. Many questionnaires are applied in many provinces during determination of occupational competence and sector research. As a result of such questionnaires, requirements of Chemistry Technology sector and their expectations from the program are determined in the generality of Turkey. These requirements constitute the base of program works.

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STUDENTS' UNDERSTADING OF THE BASIC CHEMICAL CONCEPTS IN PRIMARY SCHOOL IN CROATIA

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Croatia has a population of 4.5 million, and every year about 50 000 new students enter the primary schools. The schooling consists of three main components: primary education (age 7-14, 8 years), which is compulsory; secondary education (vocational and high schools, age 15-18, 3 or 4 years); and higher education (colleges and universities). In the last few years the entire Croatian school system inaugurated important modifications: in the academic year 2005/2006 the universities implemented the Bologna process; after experimental implementation in 49 primary schools during 2005/2006, the Croatian National Educational Standard, CNES (in Croatian HNOS) was introduced during 2006/2007 into the Croatian primary school system. CNES defines knowledge, skills and abilities to be acquired by students at various levels of their education (http://public.mzos.hr/). During the school year 2005/2006, before implementation of CNES in all primary schools, many chemistry teachers underwent intensive professional training.

In this work we describe the pilot investigation of the influence of CNES implementation on the process of learning and teaching chemistry in primary schools. Croatian students start the chemistry course in 7th grade (age 13). 367 students of the 8th grade (age 14) from 11 schools and 16 classes from all parts of Croatia participated in the study, together with 160 undergraduate students enrolled in the General Chemistry course in 2007 at the Faculty of Science, University of Zagreb. The test consisted of different types question (traditional question appeared immediately before the concept question).

The aims of this study were:

pilot study of the students' understanding of the basic chemical concepts (physical and chemical changes, element, compound, mixture and atomic structure),

detailed study of the students' understanding of the concepts of the solubility-solution and reaction equation,

identification of students' misconceptions of the preliminary concepts,

suggestion of teaching strategies to induce conceptual change, through the workshops for chemistry teachers, and for improvement of chemistry textbooks in Croatian primary schools. [1]

One of the results of our research showed that Croatian students have difficulty in understanding the significance of balanced chemical equations and in making the distinction between a saturated solution and a supersaturated solution. Such difficulties have been described also in other chemistry education reports. [2]

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TALENTSPECIFIC PROBLEM-SOLVING-STRATEGIES IN CHEMISTRY EDUCATION

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In the end of the 80´s in Germany only a few associations of parents indicated the special needs of gifted students. Today this topic increasing moves in the focus of university and school.
So far the described arrangements of giftedness advancement are mostly limited in activities outside of the regular instruction, for example the participation at contests for students ("Jugend forscht"). But the actually education in the classroom changes currently only marginal, how the results in the national school-comparative-studies for example Heller (2001) and Rost (1998) have exposed. In these studies a need for action in class-integrated advancement is explicit mentioned.
A continuative deployment and evaluation of experiments, tasks and other offers for gifted advancement implies knowledge in potentially characterizeable problem-solving-strategies, which students in different levels of giftedness applies or generate themselves. For chemistry education it would be interesting to receive gifted similarities and individual differences in problem-solving-strategies.
The Poster presents based on the munich model of giftedness[2] some problem-solving-tasks and materials for a chemistry related advancement. The conceived tasks allows a giftedness orientated differentiation. In addition the poster presents first results of a study, in which students in different levels of talent solved such kind of tasks.

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THOUGHTS ON CHEMISTRY EDUCATION

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Education is a matter of principle concern and importance to which developed and developing countries show utmost diligence. While countries building their education system on a firm ground and refreshing such in accordance with changes through ages achieved a respectful place among world nations, same respect is far apart from countries which fell behind this achievement.
Our true-bred young population, having internalized national merits and open to universal merits, contributing to information production and using such information in a composing manner, is our principal potential in 21st century both for improving the competitive potency of our country and integration into European Union.
Education, particularly vocational and technical education, is deemed to be the most effective means of development in our country which makes progress to keep up with the contemporary civilization level and even pass beyond it, just as guided by the great leader Atatürk.
As a matter of Higher Education, the systematic Chemistry Education based on a certificate was introduced by Chemistry Institute, Faculty of Science in Istanbul University in 1918. In the course of time, it passed through various progressive stages and nowadays maintains its educational mission under Undergraduate Education, Undergraduate Education for Chemistry Engineering and Undergraduate Education for Chemistry Teaching programs.
Chemistry as a secondary education branch was first introduced in M. Rüştü Uzel Chemistry Vocational School in 1946-1974. In line with developments in chemistry industry, over 10.000 students have education in Anatolian Vocational High Schools, Technical High Schools, Industrial Vocational High Schools and Multi-Program High Schools.
Anatolian Technical High Schools and Technical High Schools students receive General High School Science Branch education. Anatolian Technical High Schools and Anatolian Vocational High Schools students, on the other hand, receive foreign language education throughout their educational life besides having Chemistry education.
The student profile of Anatolian Technical High Schools and Anatolian Vocational High Schools consists of students who achieved success in LGS (High-School Entrance Exam) exam. Technical High Schools and Industrial Vocational Schools, on the other hand, receive students according to their diploma and achievement grades.
Besides Chemistry departments in Vocational and Technical Education, Rubber Technology, Plastic Technology, Process, Dying Technology, Leather Technology and Food Technology, which are prevailed to be widespread, will ensure considerable achievements in Vocational and Technical education.

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T9P22

STUDY ON RELATIONSHIP BETWEEN CHEMISTRY ACTIVITIES AND CREATIVITY INCREASE IN PRESCHOOL CHILDREN

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The present research has been performed aiming at study on effect of chemistry activities on increase in preschool boy's creativity. Plan has been of pretest and posttest experimental plan type with control group. Research has been done on 30 children. Research tool is Torrance creativity test (figural form B) which has high validity and reliability.
For the subject, 10 simple activities of chemistry were performed for 5 weeks. After this educational course, both groups were reevaluated with Torrance test. In order to analyze data, t test was used. Results showed that chemical teaching of children in brainstorming method led to increase in their creativity in four main fields of fluency, flexibility, originality and elaboration. Comparison of the results of pre and post tests between two experimental and control groups showed meaningful difference.

Keywords: preschool children, chemistry activities, creativity, fluency, flexibility, originality, elaboration.

AFTER THE BOLOGNA REFORM: STUDENT MULTIMEDIA PRESENTATIONS AS BACHELOR OF CHEMISTRY DIPLOMA PROJECTS IN TEACHER TRAINING AT THE UNIVERSITY OF GDANSK

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After the Bologna reform: student multimedia presentations as bachelor of chemistry diploma projects in teacher training at the University of Gdansk
In 2005, for the first time at the Faculty of Chemistry, University of Gdańsk, students embarked on a new programme of studies, reformed according to the Bologna process. It consisted of two tiers: the three-year Bachelor programme, followed by the two-year Master of Science programme. Accordingly, the system of chemistry teachers training changed entirely [1]. In the first tier, students were trained in two disciplines: main - chemistry and additional – informatics, answering the need for two-specialty teachers after the 1999 educational reform in Poland [2]. In 2008, the first group of graduates of this programme will receive their Bachelor of Chemistry diplomas and certificates qualifying them to teach chemistry and informatics in Polish lower-secondary schools.
During the last semester, the prospective teachers were focused on their diploma projects. For this particular group of students, the projects took a form of educational presentations, which:

- were addressed to school pupils or chemistry students
- covered some interesting and/or useful aspects of chemistry
- were suitable to be displayed on a personal computer
- had a structure similar to www document with hyperlink navigation between the pages
- contained multimedia elements, such as educational video films or animations.

Students were introduced to this task at the diploma seminars, where they become familiar with basic methodology of preparing educational presentations. Majority of the students chose to include video films, so the techniques and methods for preparation of reliable educational films [3] were covered as well. During the seminars, students chose particular topics, worked out their approaches and planned the presentations, including screenplays for films and animations. In the laboratory, students practiced the chosen experiments, optimized the recording conditions and actually recorded video sequences. The raw material was then computer-processed to give short educational films illustrating the chosen subject. Finally, the films were incorporated to the PowerPoint presentations, together with appropriate text and illustrations. Topics covered in the presentations using video films included demonstrations of basic laboratory techniques (e.g. crystallization, extraction) and interesting chemical phenomena (spectacular reactions, origin of color, detecting components of minerals and rocks). Simple animations prepared by students were used in presentations concerning heterogenic catalysis and hydrogen bonding in DNA.
Preparing multimedia educational presentations by students was quite a challenging task. Apart from chemical knowledge, it required combining together a variety of skills:

- planning computer-based presentations
- planning and performing chemical experiments
- using video camera in such a way that the desired visual effect is achieved
- acquiring and using computer skills, including planning and preparing simple animations.

Yet, the students were able to achieve surprisingly good results. They seemed genuinely engaged in the project and took great care to achieve a clear, scientifically correct and attractive message.

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T11 -Chemistry Education and Ethics

T11P01

ETHICAL PERSPECTIVES AND PHILOSOPHICAL PROBLEMS IN CHEMISTRY TEACHING

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In our days teaching chemistry is unavoidably associated with several ethical, as well as philosophical problems: pollution, sustainable development, bioethical questions,representation problems, etc.
Philosophers of science have thought and elaborated theories about these questions, for more than fifty years. However ethical problems seldom have been focused with any depth in curricula for chemistry teaching in secondary schools.
Some proposals on how to include ethical problems and discussions will be presented in this communication.

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