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AN IMPLICIT BLOCK HYBRID METHOD FOR SOLVING SPECIAL SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS

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In this paper, linear multistep technique using power series as the basis function is used to develop a block method which is suitable for generating direct solution of the special second order ordinary differential equations with associated initial or boundary conditions. The continuous hybrid formulations enable us to differentiate and evaluate at some grids and off – grid points to obtain four discrete schemes of order (5,5,5,5)_T, which were used in block form for parallel or sequential solutions of the problems. The computational burden and computer time wastage involved in the usual reduction of second order problem into system of first order equations are avoided by this approach. Further more, a stability analysis and efficiency of the block method are tested on linear and non-linear ordinary differential equations and the results obtained compared favorably with the exact solution.

Key words: Block Hybrid Method, Linear Multistep Method, Self – starting, Special Second Order.

OMANI SCIENCE TEACHERS' PROFESSIONAL IDENTITY FROM THEIR SUPERVISOERS PERSPECTIVES

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This study aims to investigate science supervisors' perspectives regarding the level of professional identity features possessed by their teachers. The sample consisted of 225 supervisors who are working as science in four educational Governorates in the Sultanate of Oman. Data was collected via a questionnaire comprising a list of professional identity features divided into four domains. The results demonstrated that supervisors indicated that teachers under their supervision possess a high level of professional identity features in the "school development" domain while they possess a moderate level of professional identity features in the three other domains: "teaching and learning", "student development" and "professional and personal growth". Recommendations for future research were proposed based on the study results.

Key words: Professional identity, supervisors, Omani teachers, science.

**BASIC SCIENCE STUDENTS' AWARENESS OF THE IMPORTANCE,
METHODS AND PROBLEMS OF AND ATTITUDE TO WASTE
MANAGEMENT IN ANAMBRA STATE, NIGERIA: IMPLICATIONS FOR
SUSTAINABLE ENVIRONMENT**

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The problem of waste disposal and management has persisted as a major environmental problem in Nigeria. Environmental education (EE) is very vital in building the capacity of individuals to address environmental issues. Within the formal system of education in Nigeria, EE is taught as part of other school subjects such as social studies, basic science, and other sciences. With the persistent problem of waste management in Nigeria, it is not certain whether the objectives of EE are actually being achieved in schools. This study therefore assessed the extent of awareness of importance, methods and problems of and attitude to waste management by Basic science students in Junior Secondary schools in Anambra State, Nigeria. A sample of 816 students was used for the study. Data were collected using structured questionnaire. Results show that Basic science students' level of awareness was high for importance, moderate for methods and high for problems of improper waste management. The students also have a high positive attitude to waste management. The implication of these findings is that the environmental education given to the children is having positive impact on them and there is hope of ensuring a future sustainable environment in the state.

REDEFINING MATHEMATICS CLASSROOM CULTURE FOR SUSTAIN- ABLE DEVELOPMENT IN SENIOR SECONDARY SCHOOLS IN RIVERS STATE, NIGERIA

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Persistent poor performance in mathematics has been attributed to several factors including lack of interest, negative attitude by students, poor teaching methods etc. Mathematics is a tool for scientific and technological development and the environment has a significant role to play in this development. Hence, the environment should be conducive to the attainment of the scientific and technological advancement required. In this contribution, the influence of classroom culture/activities and structure on the academic achievement of the students was investigated bearing in mind that for sustainable development in the teaching and learning of mathematics the classroom environment, activities and structure are of paramount importance. A purposive sample of 150 teachers teaching mathematics formed the respondents for the study. A structured questionnaire on mathematics class- room culture in schools which was designed by the researchers. Data collected were analyzed and recommendations were made based on the findings.

KEYWORDS: Mathematics classroom culture, learning environment, sustainable development, redefining,

EFFECTS OF EXPERIENTIAL LEARNING STRATEGY ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN BIOLOGY

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This study investigated the effects of experiential learning strategy on secondary school students' achievement in biology. The study employed a non equivalent control group quasi experimental design. The sample for the study comprised of seventy four (74) Senior Secondary School class 1 student drawn from two intact classes that were randomly drawn from two co-education school in Awka urban area of Anambra State of Nigeria. Out of the two schools drawn for the study one was assigned to the treatment group while the remaining school was assigned to the control group. The treatment group was taught biology using the experiential learning strategy while the control group was taught the same concepts in biology using the expository strategy. Two research questions and three null hypotheses guided the study. A biology Achievement Test (BAT) was used to collect data for the study. Data were analyzed using mean, standard deviation and the Analysis of Co-variance. The result revealed that experiential learning which a vital aspect of "Live Science" is superior to the conventional expository strategy in enhancing students' achievement in biology. In the same vein experiential learning does not discriminate across gender in student's achievement in biology.

**ENGAGEMENT STRATEGIES FOR MAKING STUDENTS LIVE SCIENCE,
LOVE LEARNING AND CREATE CHANGE IN THE SOCIETY ---
TEACHER AND HOME FACTORS**

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The purpose of this paper is to look at engagement strategies teachers and parents can adopt to make students live science, love learning it and create change. It looked at the role of teachers and parents by creating love for learning in their children, through modeling a love for learning, starting early with learning science with students/wards and having a lot of scientific items for learning, such as computers, good software's, learning games et.c. in their homes and school which students/wards can interact with. Other strategy is to engage students in activities since this will promote opportunities for creative thinking excite and enthuse young people in science, provide challenging problem solving activities and improving planning and analytical skills among others. Some of these activities are enumerated in the paper. The implication of this is that if students are engaged with various activities, they will see science as fun, love to continue to learn it and will not see science as a separate entity from their life.

INFLUENCE OF MOTHER'S ASSOCIATION ON GENDER DISPARITY IN SCIENCE CLASSROOM IN NORTHERN PART OF NIGERIA

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Gender issue has become an issue of concern in the past decade in sub-Saharan African countries (Nwasofor, 2001). United Nations Children Education Fund(UNICEF,2007) confirmed that the global figure for out of school children is estimated at 121million in which 65 million are girls and 80 per cent live in sub-Saharan Africa. In Nigeria, girls' access to education by girls is generally low in the northern part (Nimadu, 2000). The statistics have shown that the enrolment ratio of girls to boys ranges from 1girl to 2 boys in some states while it is 1girl to 3 boys in other states. Some available data also indicated that 12 million Nigerian primary school aged were out of school about 7.6 million are girls. The national net enrolment ratio is estimated to be 58 per cent for boys and 48 per cent for girls, this gave an average gender gap of 10 per cent in favor of boy (United Nations Development Project (UNDP), 2005). With these fewer girls enrolment for primary education only a few transit to junior secondary and senior secondary schools (UNICEF, 2008). Out of those that managed to get to the secondary level only a few or none are found in science classes. This research work aimed at improving female participation and enrolment in science classrooms in Kaiama Local Government Area the northern part of kwara state with mother's association as intervention. The paper also examines the changes brought by this association since its establishment. More so, the paper was able to identify barriers and limitation to female enrolment and participation in sciences. Kaima area has been tagged as education disadvantaged area by kwara state government not to even talk of science courses.

THE SYSTEMS OF REPRESENTATION IN EARLY SCIENCE EDUCATION

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The teaching of science in the early years of education is an issue around which a large number of studies have been performed (Carvalho, 2004, 2007; Sasseron & Carvalho, 2007; Dewey, 1897; Bruner, 2007; 2008; Vega, 2006; Deighton, Morrice & Overton, 2011; Johnston, 2005, 2011). Such discussions are related to the change of focus that teaching and learning of science have been suffering due to the adoption of a sociocultural perspective of education grounded in the sociocultural approach stated by L. S. Vygotsky (2003; 1962). Although many researches point to the important role of the science education in the child's development, how to integrate it in the everyday school still represents an enormous challenge for the early year's teachers (Monteiro & Teixeira, 2004; Fourez, 2003; Jiménez-Aleixandre, Rodrigues & Duschl, 2000; Driver & Newton, 1997). The purpose of the research presented in this paper was to contribute to a better understanding of the child's scientific meanings process and their implications to the early science education. Therefore, students from the first grade of Elementary School (5 to 6 years old) developed different kinds of representation (Bruner, 2008) about the subjects studied during the interdisciplinary project "Solar System

FOSTERING A GROUP OF SCIENCE TEACHERS SUPPORTED BY AUDIOVISUAL RESOURCES TO APPROACH THE NATURE OF SCIENCE IN TEACHING SITUATIONS

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The approach of science teachers' conceptions about the nature of science (NOS) is a subject widely found in the literature (Akerson, Abd-El-Khalick and Lederman 2000; Bell, Lederman and Abd-El-Khalick 2000; Harres 1999). Basically the question resume trying to understand how these concepts could influence the practice of teachers in real classrooms. For that the processes of teacher training are critical if they are embedded in contexts that encourage teachers to reflect on the nature of science so that teachers' conceptions are translated into real actions in the classroom. (Akerson, Abd-El-Khalick and Lederman 2000). The contributions of Akerson and colleagues (2012) were also important because it allowed us to understand how teachers supported by a community discussion of the nature of science, give practical meaning in their conceptions of science and education involving the NOS in teaching situations real learning. Audiovisual resources using commercial movies with the potential for communication and discuss internal and external aspects of scientific activity. This has the potential benefit of stimulating inter-ests, i.e., inspiring what teachers are willing to teach and what is attractive to students with the audiovisual language, due to its sensory and emotional appeal.

**EFFECTS OF MASTERY AND ACTION LEARNING STRATEGIES ON
LOW ABILITY LEVEL STUDENTS' ACHIEVEMENT IN NIGERIAN
SENIOR SECONDARY SCHOOL PHYSICS, USING "LABLESS LAB" KITS**

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It is expected that the findings of this study will find application in classroom teaching where the teachers will be encouraged to adopt various instructional strategies such as mastery and action learning strategies that lay emphasis on learning by doing in order to engage students in creativity, problem solving, reflective thinking, originality and invention which are vital ingredients for science and technological development. Also, the findings of the study will enhance student's "achievement in the concept of heat energy in physics especially, the low ability level learners when taught using mastery and action learning strategies. The results emanating from this work will also help the Science Teachers Association of Nigeria (STAN), federal and state ministries of education and other related agencies in planning and organizing conferences, seminars and workshops for physics teachers in order to enhance hands-on activities.

STATUS OF SAFETY AWARENESS AMONG SENIOR SECONDARY SCHOOL SCIENCE STUDENTS IN AKWA IBOM STATE OF NIGERIA

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The study aimed at determining the status of safety awareness of senior secondary school science students. It also examined how students' safety awareness varies with their gender and school location. Adopting a descriptive survey research design the study was guided by three research questions and two null hypotheses. Using a stratified random sampling technique, 3906 science students drawn from Senior Secondary Schools in Akwa Ibom State were used for the study. Data was collected using a safety awareness questionnaire and analyzed using means, percentages, and t-test. The result of the analysis of data collected showed that science students from Akwa Ibom State had just an above average knowledge of laboratory safety. The result also showed that the students' level of awareness of laboratory safety is not dependent on their gender and school location. Based on these findings some recommendations were made which include organizing safety week in schools, enforcing laboratory rules by science teachers, providing safety materials and equipment in the laboratories, classrooms and around the school compounds. It was also recommended that teachers incorporate safety issues as part of their lessons especially during science practical lessons.

DESCRIPTIVE ANALYSIS OF STUDIES ON LABORATORY SAFETY ISSUES IN TURKEY

Akpullukcu Simage

Studies in European Union countries suggest that in secondary schools, students' interests and attitudes toward science have been reduced according to the increase at grade levels. In order to prevent this problematic situation, the EU suggests that science educators should use Inquiry Based Science Education (IBSE) in their classrooms. One of the important components of inquiry based science education is science laboratories that can provide students learning with inquiry. We can say that the science laboratories are more dangerous than the class environments at schools. Almost all laboratory techniques can cause injuries or to exposure a variety of risks. Young (1991), states that usually secondary school laboratory practices includes the applications performed by students who don't have awareness about hazards of chemicals and equipment. In this process, students might encounter with dangerous situations. They can break glass based materials and use the tools with incorrect interactions. These accidents sometimes can cause a simple cuts or injury but may be sometimes it may cause severe burns and serious injuries. Therefore it needs to have some arrangements and educational interventions that can minimize the damages by conscious interventions against such accidents. For the reasons that explained above, science teachers are the most responsible persons for the lab studies in the schools. Thus, teachers must be trained on the lab safety issues using in-service training possibilities. The studies carried out in this field show a positive correlation between some variables such as science teachers' knowledge, experience, perspective of the laboratory and safety (Çepni et al, 1994). It is clear that the numbers of research studies on lab safety are very limited in Turkey. How many of them highlight the safety issues of laboratories at schools?

The main aim of this study is to research the researches on the lab safety in science education research area in Turkey. For this reason, many graduate studies, conferences, papers, and journal articles were examined. In these reviewed studies, the keywords and variables of laboratory safety were examined to determine the frequency with which factors were discussed. Percentage and frequency values are presented in order to understand the situation in Turkey.

SUSTAINABILITY SCIENCE: A NEO-NORMAL

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The adverse impacts of global warming and climate change, which is caused by accumulation of greenhouses gases particularly anthropogenic CO₂ , remains a big challenge to human civilization today. In spite of this everyone continues to exploit economic opportunities just to experience a luxurious life at the expense of our natural resources which puts our environment at great risk. Our education system has failed to educate the citizens about the current socio-scientific issues which affect their everyday lives. Though our schools were able to produce technologically literate graduates yet they are ecologically illiterate. Science being a systematic body of knowledge has not provided substantial norms and platforms of integrating real-life issues among the various disciplines which supposedly offer connections to the lives of learners. In response to the urgency of raising environmental literacy, adaptation and mitigation skills, the authors propose an innovation that leads to sustainability. Sustainability science is a neo-normal contextualized systematic body of knowledge (science) revolving around socio-scientific issues and aimed at shifting paradigm of learning from a theoretical dimension to contextual in nature. The learning paradigm emphasizes trans-disciplinary and interdisciplinary processes aimed at removing boundaries among disciplines for a more holistic student learning outcomes.

Keywords: Sustainability science, neo-normal, adaptation, mitigation, sustainable development

**ENTREPRENEURSHIP; PERFORMANCE INDICATOR FOR
INNOVATIVE/ SKILL ACQUISITION: IMPERATIVE TO PEDAGOGY OF
SCIENCE AND TECHNOLOGY EDUCATION (STE)**

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The confidence in school leavers of Science and Technology Education (STE) to take risk and venture into self-employment or create jobs, even when relevant innovation and skill have been acquired is lacking in most of these days graduates. This has put many of these graduates on over stretched waiting list of unemployment hoping to be employed in almost non existing formal sectors. This and other variables have placed education content and delivery under scrutiny, indicating a mismatch between the learning outcomes of education and the needs of society, industry and economy. The paper contributes to the ongoing debates on making education content and delivery relevant to the needs of the environment. We attempt to highlight the role entrepreneurship can play as a catalyst to solving problems of lack of innovation, skill and jobs creation. Several suggestions were proffered for modification of STE content, delivery and assessment. The steps to the path of impacting entrepreneurship in every course content and delivery of STE were defined.

TECHNOLOGY ASSISTED LEARNING (TAL): A POTENTIAL FOR THE ACQUISITION OF BASIC SCIENCE PROCESS SKILLS AND ICT SKILLS BY SCHOOL CHILDREN

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Technology Assisted Learning (TAL) is viewed as a broad base learning experience that has a good potential for the mastery of science process skills and concepts and skills in ICT. As simple and complex technological devices are becoming part and parcel of every society it is seen pertinent for teachers and parents to use them for the achievement of other purposes besides recreation and play. In this paper the help of children was solicited in identifying various games they play with some common technological devices. The potentials of these games in learning ICT skills and some science process skills was deduced and it was observed that most of such games can be the basis for the acquisition of some simple science process skills and very importantly they supply children with the readiness and motivation to learn formal ICT skills and concepts. As teachers and parents observe children's preference in these games they can deduce their interest and use them to guide the children towards better goals setting and achievement in school and life in general.

ALTERNATIVE SOLUTIONS TO THE DECLINING INTEREST IN SCIENCE EDUCATION AMONGST MALAYSIAN STUDENTS

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Although the problem of the declining interest in science education amongst Malaysian students is not new, the solutions to this issue have yet to be realized. In Malaysia, the appeal of science education in schools (primary and secondary) have now dropped to a critical level with the number of science stream students dropping by 29% since 2007, astoundingly far from the targeted 60% by 2020. New approaches and 21st century innovative thinking is required to address this long-standing world-wide phenomenon. This paper outlines the probable reasons for this worrying trend which include how science education is defined within Malaysian schools; the rigid methodology of science teaching; the obstructive administrative structures of schools which are not suited to the inquisitive nature of science and the lack of priority given to the subject by schools. The paper proposes fresh approaches and contemporary attitudes to tackle this matter. These solutions involve re-defining the realm of science in the school curriculum, rethinking traditional methods of assessments (particularly examinations) within science education, matching science curriculum with student interests, integrating science education with other disciplines, and emphasizing science education from early age.

Keywords: science education, Malaysia, declining interest, schools, science curriculum

EFFECT OF REFLECTIVE-RECIPROCAL TEACHING STRATEGIES ON PRE-SERVICE TEACHERS' ACHIEVEMENT IN INTEGRATED SCIENCE AND SCIENCE PROCESS SKILLS IN NIGERIAN COLLEGES OF EDUCATION

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The low level of performance of pre-service teachers in Science has been a recurrent problem in science education. Poor instructional strategies employed by lecturers in Nigerian Colleges of Education have been adduced as one of the reasons for this. Previous researches have focused on collaborative and self-regulation strategy without considering opportunity for reflection before, during and after lessons which Reflective- Reciprocal Peer Tutoring (RRPT) and Reflective-Reciprocal Teaching (RRT) addresses. The pretest-posttest, control group quasi experimental design was used. One intact class of year two pre-service teachers' was selected from six purposively selected colleges in southwestern Nigeria making 295. Five instruments were developed Data were subjected to Analysis of Covariance and Scheffé Post-hoc test. Treatment had significant effect on pre-service teachers' achievement in Integrated Science and science process skills ($p < 0.05$), Pre-service teachers exposed to RRPT obtained higher achievement score ($x = 24.8$) than RRT ($x = 21.2$) and control ($x = 18.55$). For Science Process skills, the RRT group had higher score ($x = 57.44$) than RRPT ($x = 43.22$) and control ($x = 41.48$). The RRT and RRPT strategies enhanced pre-service science teachers' achievement and science process skills. When employed, the strategies could improve pre-service teachers' achievement and science process skills Key words: Reflective-reciprocal teaching, Reflective-reciprocal peer tutoring, Colleges of education, Achievement in integrated science, Science process skills.

REMOVAL OF RESIDUAL OIL IN PALM OIL MILL EFFLUENT(POME) USING SURFACTANTS

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Palm oil mill effluent (POME) is oily wastewater produced from palm oil extraction process containing high amount of organic contaminants and residual oil. Discharging POME to the river will deplete the amount of dissolved oxygen in the river and endanger the aquatic life. Therefore, the residual oil and grease in POME must be removed before being discharged into the river. In this study, the residual oil was removed by using single and mixed surfactant system; nonionic Brij-30, anionic GE460 and their mixture. Parameters studied were concentration of single surfactant, ratio of surfactant in mixed surfactant system, mixing time, mixing speed, and mixing time. The results showed that the optimum conditions for the removal of residual oil in POME are 1×10^{-4} M of GE-460 and 1×10^{-5} M Brij, mixture of surfactants with ratio of 1:1, mixing time of 30 minutes with mixing speed of 180 rpm. The average value for the extracted oil under the optimum condition was 1550 mg/L. For qualitative analysis of oil and grease, the bonding in extracted oil and grease was analyzed by using Fourier Transform Infrared spectroscopy (FTIR). FTIR spectra showed the presence of CH₂ at 2930 cm⁻¹, a common characteristic of oil and non polar part of surfactant.

Keywords: Palm oil mill effluent (POME), residual oil, anionic (GE-460), non-ionic (Brij-30), FTIR

PROMOTION OF SCIENCE EDUCATION THROUGH SIMPLE EXPERIMENTS

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Children love to explore the world around them because they are observant as well as curious. In the classrooms they are suppressed by the chalk and talk way of teaching. Science teachers have at their disposal the single most powerful tool in all education: lecture cum hands-on demo experiments which are short, simple and no-cost low-cost. The scientific skills of the students can be improved by teaching them the concepts of relevant scientific principle with activity based hands-on demo. Historically “seeing is believing” or “show and tell” has probably been the best educational technique ever employed. A demo experiment gives a better understanding of scientific ideas as well as makes the study interesting and fun for the teachers and their teachers. The author is a senior resource person of two projects since 2004, a joint venture of National Academy of Science India (NASI) and IIT- Kanpur for the Teachers’ Orientation Programmes and also West Bengal District Scheme Interactive Science Workshops for the middle school students.

BIODIVERSITY RESOURCES OF THE OGRIDIGBEN FOREST, DELTA STATE NIGERIA

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Biodiversity inventories are the primary means by which floristic and fauna diversity of an area can be understood and are essential in underpinning management plans for conservation. Data on the floristic resources of the forest were obtained using modified Whittaker technique while information on the fauna inventory was obtained using direct and indirect wildlife markers. Estimate of the biodiversity indices measured include frequency, richness, evenness and diversity. Sixty seven plant families were recorded including rhizophaceae, fabaceae, rubiaceae, euphorbiaceae and arecaceae amongst others. Along with these families, 136 plant species were also recorded including *Canarium*, *Azelia*, *Cleistopholis*, *symphonia* and *Lophira* amongst others. Dominant woody plant species include *Rhizophora*, *Heliotropium*, *Elaeis*, *Anthocliesta* and *Ricinodendron* with more than 75% occurrence in the sampled plots. Plant diversity, evenness and richness were estimated to be 3.07, 0.94 and 136 respectively. Among the wildlife sighted in the forest include 19 mammals, 72 avifauna, 10 reptiles, and 4 amphibians. Index of wildlife diversity evenness and richness were 3.82, 0.89 and 105 respectively. This information was used to delineate a conservation corridor and the production of a biosensitivity map to aid policy planners.

USING WONDER TO FOSTER A 'LOVE OF LEARNING' IN SCIENCE

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A common challenge for many primary pre-service teacher educators is to rekindle interest in science content with future teachers. These prospective teachers often express antagonistic feelings toward science because of a lifetime of negative associations with school science. In the spirit of the conference theme of “love learning” this pilot study investigated if the notion of wonder could be utilized with preservice teachers as a vehicle to develop positive conceptions of science as an answer to our current ‘crisis of interest’ as described by Tytler (2007). Findings suggested the use of a wonder framework generated both increased interest and more positive views regarding science content. Using three individual student cases, the study demonstrated a shift in desire to learn science content that they had claimed to detest before engaging in the experiences related to the study. In all, the results of utilizing a wonder framework with adult students offered promising results. This study further argues that we may need to conceptualize school science as not just a way to understand the world but also to clearly demonstrate that it is a field of inquiry that is sustained by mystery, beauty and wonder.

CONTRACTUAL ARRANGMENTS FOR BUILDING: AN EDUCATIONAL GUIDANCE TOOL FOR UNDERGRADUATE CIVIL- ENGINEERS

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Clarification, confirmation and enactment of contractual arrangements are an essential, somewhat unexpected, component in the daily workload of both graduate and experienced Civil Engineers; unexpected because traditional educational processes emphasize theoretical technical compliances, with very limited content that prepares graduates for an implementation of the necessary procurement paths between parties who design, and those who build. Given this limitation in current course structures, the work presented here has a key objective of addressing the need for (undergraduate and graduating) civil engineers to be knowledgeable in legal relationships to realize project design intentions. Practitioners must ultimately navigate: appropriate procurement strategy; appropriate tender process to engage contractors and consultants; suitability of contract type; and, which standard form of contract best serves the project's needs. This research project developed a structured, objective decision-making guide, predominately for new civil engineers at their formative stage(s). The work conducted builds upon previous research to provide a comprehensive overview of, not only the factors to be considered to make an appropriate decision, but also the final contract-product and its relative advantages and limitations.

UNDERGRADUATE CIVIL-ENGINEERING TRAINING REQUIREMENTS TO FACILITATE INTEGRATED PROJECT DELIVERY (IPD)

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The Australian Government Department of Innovation, Industry, Science & Research suggests there to be limited training (across the construction supply chain) able to facilitate Integrated Project Delivery (IPD), and that this represents a barrier to effective and efficient interdisciplinary working within the building industry generally; they argue strongly that training is critical to increasing Building Information Modeling (BIM) implementation in Australia, to ensure that the sector remains competitive. The research presented here has, as a key objective, an assessment of the current knowledge base(s) that might be tapped into to facilitate/encourage improved integrated project delivery in the (Australian) construction industry and, more specifically, assist graduate Civil Engineers in BIM processes that, arguably address fragmentation, towards improved communication and quality control. Effective implementation of BIM systems, towards integrated project delivery, requires industry and higher educational institutions to address a current lack of training; indeed with many companies hesitant to embrace BIM because of the daunting and costly process of re-training staff, the onus of responsibility for skill generation falls principally to those charged with the maintenance of undergraduate course relevancy. The work conducted here seeks to assist undergraduate (civil) engineering courses to maintain such relevancy.

CROSS-DISCIPLINARY PROJECT-WORK, INTEGRATED WITHIN UNDER- GRADUATE CONSTRUCTION COURSE STRUCTURES

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Building design teams are made up of a wide range of construction specialists brought together, relatively briefly, to realize individual one-off built-asset development briefs. However specialist fragmentation can affect performance negatively and, is apt to create professional dissonance, and less practicable innovative design solutions. Empathy with other professionals and acknowledgement of the potential of specialist databases irrespective of the mode of communication-and-sharing adopted, is required. This process must then acknowledge the attitudes, values and distinct professional cultures of the specialist disciplines. Whilst mistrust may not be explicitly, causally related to a lack of specialists' integration, implicit association does reflect a need for research on formative-stage integration of the disparate design team specialists. The main objective of the work presented seeks to highlight attitude differences amongst building design team practitioners, by evaluation of a (developed) attitude scale, given to a range of (over 500) undergraduate students at the formative stages of respective vocational courses, towards identification of a way ahead to target more specifically (and emphasize positive rather than negative) attitudes towards disparate peer-groups, through the staging of cross-disciplinary project- work, integrated within undergraduate construction course structures. Understanding of basic science concepts. Data were collected from participants of a ten- day workshop as part of the professional certification program. Teachers' understanding is identified using a multiple choice test accompanied by a degree of certainties to the answer. The test identifies essential science concepts appeared by the national curriculum. The study finds that many teachers do not have solid understanding of science. Misconceptions are also identified in a number of areas. Student textbooks, myths spread over in the communities, and narrow interpretation of religious teaching are some source of teachers' misconceptions. The lack of formal course on science leads teachers to rely on common knowledge for explaining scientific phenomena. This finding suggests that fu- ture professional development program for primary school teachers should be designed around subject matter and subject matter pedagogy rather than pedagogy.

**A SYSTEMATIC APPROACH TO IBSE IMPLEMENTATION IN
ITALY : BUILDING A MODEL THROUGH THE PROGRAM
“SCIENTIAM INQUIRENDO DISCERE” - SID**

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The program Scientiam Inquirendo Discere aimed to introduce and improve the Inquiry Based Science Education in Italy building a systemic and systematic model. It is a collaborative National Program between the Accademia Nazionale dei Lincei and the National Association of Natural Science Teachers. The identification of strategies for building the model were performed by a strong cooperation with the French Academie des science and the Programme La main à la pâte and by accessing to resources and models of IBSE program of other European countries .The participation of ANISN at the Fibonacci European project (FP7) allowed the setting of the pillars of the model focused on teachers’ professional development on IBSE as the key point for the renewal in teaching Science at school. The program has a complex multilevel organization with national advisory structures and local “pilot centres” .In two years six pilot centres have been set up, they are located in prestigious research centres or academia in Naples, Venice, Rome, Pisa, Turin and Milan. The program represents a model of cooperation and achieves important strategic objectives consisting in enhancing and profiting from previous experiences and initiatives, strengthening international collaboration, providing a sophisticated tool for implementing and assessing IBSE approach.

REINSTATEMENT OF INDIGENOUS FLORA IN THE URBAN ENVIRONMENT OF NEW ZEALAND: A CASE STUDY FOR HAMILTON CITY.

Antoinette Van Der Weerden

Loss of the New Zealand's original ecosystem is the result of rapid colonization over the past 200 years. New Zealand currently retains 23% of its original vegetation much of which is in mountainous areas. Vegetation loss can be attributed to industrial food production processes underpinned by forest clearance and swamp drainage. A further loss was gained through the introduction of voracious pest plants and animals. Only 1.6% of the original vegetation is present in the Hamilton ecological district. The loss of vegetation and associated fauna has led to a loss of landscape character. A literature study has been undertaken combining the results of numerous studies conducted over approximately 80 years. Soil types, landforms and plant species lists have been matched and a matrix has been compiled with the purpose of mobilizing the homeowner to reinstate the regional indigenous vegetation into home garden spaces. The study presents opportunities for indigenous flora to be reinstated in the home garden and urban landscape. The increased visibility of the original flora in home garden spaces reveals Hamilton's lost landscape character and re-dresses our ecological loss.

A ‘BLENDED’ MODEL FOR SCIENCE TEACHERS TRAINING

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International surveys on Science Education (TIMSS and PISA) have indicated a low level of science performance of the Italian students, with an evident decrease during the lower secondary school and especially low results in the regions of the South of Italy. Focusing on this target in 2009 the Italian Ministry of Education launched within the PON (National Operational Program), funded by the European Community, an innovative science training project: the PON Educazione Scientifica. In three years more than 800 science teachers have been involved. The program developed a “blended” model, characterized by in-presence training courses and online activities. A group of experts and authors outlined a corpus of 60 teaching proposals, moreover they created innovative resources that foster a productive integration of teaching and learning “tools” and “languages”: from pencil to microscope, from test-tubes to IWBs, from observation to videos creation, from ruler to calculation software, in a dynamic synergy created by old and new technologies, old and new languages. The approach, the organization of contents and the training plan represent a new model for science teachers training in Italy. The first results show a large teacher satisfaction coupled with an improved interest to new approaches in science education.

PRIMARY SCHOOL TEACHERS' UNDERSTANDING OF SCIENCE AND ITS IMPLICATION FOR TEACHER PROFESSIONAL DEVELOPMENT

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The recruitment system of primary school teachers that allowed non-primary school education graduates to become primary school teachers result in many primary school teachers never attend science course. This study aims at identifying primary school teachers'

**ASSOCIATION BETWEEN FOUNDATION KNOWLEDGE
COMPETENCY AND ACADEMIC STANDARD OF SCIENCE STUDENT
IN A UNIVERSITY**

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Although the notion of decline in academic standard of university students has been de- scribed and debated by educationists locally and worldwide, actual studies to investigate the cause and/or associated factors have not been comprehensive. In Malaysia, public opinions thus far have attributed the cause to low proficiency in English and the lack of independent learning skills. However, proper empirical investigation into these have not been done, and therefore, the core cause(s) of falling standard of university students remain ambiguous. This study reports the findings on the testing of the hypothesis that declining academic standard of local university students correlates with the lack of familiarity and competency in fundamental content knowledge, as per scientific knowledge. Empirical analysis reveals this hypothesis to be true, and suggest that low competency in fundamental content knowledge of science may be one of the causes of the fall in academic standard among science students in university. The implication from this will be the need for university educators to reinforce the instruction of fundamental content knowledge in the early years of university education.

RADIOACTIVITY IN BOTTLED DRINKING WATER AND THE HEALTH CONSEQUENCES ON INFANTS AND CHILDREN IN ONDO STATE, SOUTH- WESTERN NIGERIA.

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The activity concentration of natural radionuclides in thirty two (32) brands of bottled drinking water samples collected from major towns in Ondo State was determined using high purity germanium (HPGe) detector. The results show that their activity concentrations ranged from 50.53 ± 4.65 to 207.01 ± 14.25 Bq l⁻¹. The average activity concentrations for ⁴⁰K, ²¹⁴Bi, ²¹⁴Pb, ²²⁴Ra, ²²⁶Ra, ²²⁸Ac and ²³²Th in the samples were 70.28 ± 4.20 Bq l⁻¹, 3.20 ± 0.43 Bq l⁻¹, 2.50 ± 0.38 Bq l⁻¹, 1.30 ± 0.29 Bq l⁻¹, 12.35 ± 1.86 Bq l⁻¹, 5.25 ± 0.78 Bq l⁻¹, and 2.31 ± 0.54 Bq l⁻¹ respectively. The annual effective doses for infants and children (that is: age groups 0-1 y, 1-2 y and 2-7 y) were determined using the average activity concentration of each radionuclide and its ingested dose conversion factor. The annual effective dose ranged from 1.40 ± 0.25 to 37.5 ± 4.36 mSv y⁻¹. The values of the activity concentrations and the estimated annual effective doses were higher than the 1.0 Bq l⁻¹ and 0.1mSv y⁻¹ recommended by World Health Organization (WHO) respectively. This is an indication that brands of bottled water sold and consumed in Ondo State are not usually screened for radionuclides.

EFFECT OF INSTRUCTION IN ENVIRONMENTAL EDUCATION ON SENIOR SCHOOL CHEMISTRY STUDENTS' PERCEPTIONS OF WASTES MANAGEMENT IN ABUJA, NIGERIA.

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This study focused on the effect of instruction in Environmental Education on Senior School Chemistry Students' Perceptions of Wastes Management in Abuja, Nigeria. The sample comprised 195 senior secondary one students. An instrument titled Students Perception Analysis Questionnaire (SPAQ) was used for data collection. The data collected from pre-test and post-test scores for both experimental and control groups were analyzed. The finding of this study revealed that: students who received instructions in EE had a positive perception about waste management better than students who did not receive EE instruction; that scoring level of students did not affect their perception on waste management and gender difference of the chemistry students did not influence their perception on waste management. Based on the findings from the study, recommendations were made.

Key Words: Environmental Education, Perception, Waste Management, Scoring level, Environmental Education Instruction, Influence, Waste.

ADVANCING SCHOOL AND COMMUNITY BIODIVERSITY MONITORING UTILISING MOBILE TECHNOLOGY

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Mobile technologies utilized in the classroom by teachers, who are poised to make a difference in the way we see nature and the environment, are mobilizing the next generation of naturalists and forging a new pathway in responsible stewardship of the planet. Teachers from the Kimberley, Western Australia, in collaboration with community partnerships are engaging students from Kindergarten to Year 12 to undertake biodiversity monitoring of iconic species. The monitoring project was initiated in response to threats to wildlife by the Cane Toad (*Bufo marinus*). Imminent invasion of the West Kimberley from this aggressive introduced predator will have a destructive impact on unique fauna and eco- systems of region. Students, using monitoring apps, log field data and populate longitudinal data bases of species at risk to aid researchers. Using these technologies, teachers are actively modeling constructive and appropriate ways for students to engage with their environment and harness the vast potential of mobile technologies and social media. With the exponential development of new nature apps, tablets and “smartphones have become the butterfly net of the 21st Century” (Wall Street Journal, 2012, describing Project Noah a modern wildlife recording tool).

DERBY DISTRICT HIGH SCHOOL'S FISHING LINE RECOVERY BIN PROJECT: ENVIRONMENTAL EDUCATION AND PERSUASIVE TEXTS

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Whilst researching the effects of littering and plastic on the marine environment Primary students from Derby District High School, in the Kimberley, Western Australia, initiated a community education project to install Fishing Line Recovery Bins along the Derby Jetty; a popular fishing spot for locals and tourists alike. Through enquiry based learning, utilizing persuasive texts, students participated as active citizens by undertaking cooperative action to protect and enhance their marine environment and be instrumental in building a sustainable future. Students wrote letters; designed 'two-way' (Standard Australian and Aboriginal English) signs and bumper stickers; made posters and brochures; wrote and recorded a radio advertisement and produced a documentary to encourage fishers to use the bins to reduce litter and wildlife entanglement from discarded fishing line and plastic waste. Support from the Department of Fisheries and the local community has enabled the project to extend to other local fishing spots further afield. The initiative has received recognition as a Finalist in the Western Australian Environment Awards and the World Environment Day Awards and has had a flow-on effect with interest from the Swan River Trust, Seabird Rescue and Bushranger Cadets in other coastal locations.

ETHNOCHEMISTRY AND ETHNOMEDICINE OF ANCIENT PAPUA NEW GUINEANS AND THEIR USE IN MOTIVATING STUDENTS IN SECONDARY SCHOOLS AND UNIVERSITIES IN PNG.

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For more than 50,000 years of Papua New Guinea's human history, Papua New Guineans have been making significant contributions to Science, particularly in the fields of Chemistry and Medicine. However, because of the absence of any written language for over 800 dialects, the information has not been recorded and the contributions of ancient Papua New Guineans have largely gone unnoticed and unrecognized. However, during the past 40 years some researchers (Holdsworth 1970, 1975, 1986, Woodley 1991, Timi 1994, Dindi 2008, Rai 2009) have conducted scientific studies on medicinal plants in PNG which probably would have been used by ancient Papua New Guineans to treat deceases. Three years ago, the author was able to introduce a Unit in the Grade 11 and 12 Chemistry Syllabus under the title 'Traditional Chemical Practices' which consists of traditional chemical and medicinal activities. Similar units had been introduced at undergraduate level in the University of PNG 7 years ago. Already there is evidence that the learning of what their ancestors had discovered and used has been an inspiration to students, and can stress the importance of learning modern scientific principles and methods to build on what their forefathers had done. This paper summarizes some of the scientific contributions of ancient Papua New Guineans, and endeavors to show how the studying of them at school and university levels may have influenced students to join chemical and medical streams at universities and encouraging first year undergraduates to take up chemistry in later years

CUMULATIVE EFFECTS OF UNDERSTANDING PRE-REQUISITE CHEMISTRY CONCEPTS ON PROBLEM SOLVING ABILITY AMONG SENIOR SECONDARY SCHOOL STUDENTS, ZAMFARA STATE, NIGERIA.

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This research examined the cumulative effects of understanding learned pre-requisite chemistry concepts on problem solving ability among senior secondary school students. Three Hundred and Ninety Four students and Ten chemistry teachers took part in the research. Three instruments, Modified two-tier multiple choice (M.T.M.C), Instances of difficult chemical concepts (I.D.C.C), and Teachers' views on learning chemical concepts (T.V.L.C) were prepared and used for data gathering. The findings of the research show that there is a wide gap between factual knowledge and problem solving performance in the proportion of 58.9%: 35.9% in favor of factual knowledge. The study found SS III students' performance on pre-requisite concepts higher than that of SS II students. The difference is statistically significant as t calculated $6.81 > t$ critical 1.96 at 0.05 probability level. On difficult chemical concepts, teachers and students differ on perception of 13 fundamental chemistry concepts. The difference in 8 of these concepts is statistically significant. . Based on the findings, the following recommendations are made which include: Teaching and learning of chemistry should emphasize inter-relatedness of concepts so as to minimize the misconceptions between factual knowledge and problem solving. Tests and examinations given to students should reflect understanding of chemistry concepts rather than simple recall of factual knowledge.

PRE-SERVICE SCIENCE TEACHERS' LEVEL OF AWARENESS OF STRATEGIES FOR ADAPTING TO THE IMPACT OF CLIMATE CHANGE IN NIGERIA

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The study investigated the status of pre-service science teachers' awareness of the strategies for adapting to the impact of climate change in Nigeria. Adopting a descriptive survey research design, the study was guided by four research questions. Using a stratified random sampling technique, 100 pre-service science teachers of the Faculty of Education of Nasarawa State University, Keffi was used for the study. Data was collected using a climate change awareness questionnaire and analyzed using means and percentages. It was found that majority of the respondents were not well informed about issues of climate change as it relates to its meaning, causes and impact. A wide variation also was shown on the level of awareness based on their areas of specialization. It was shows that the pre-service science teachers' level of awareness of strategies for adapting to the impact of climate change was below average. It is therefore recommended that issues relating to climate change and disaster risk reduction be infused into the curriculum content for the training of pre-service science teachers. General Studies courses should be introduced to address current issues like climate change. Seminars, public lectures and workshops could be organized for pre-service, in-service and serving teachers.

EFFECT OF CONCEPT MAPPING TECHNIQUE ON STUDENTS' COGNITIVE DEVELOPMENT IN NIGERIA: IMPLICATIONS FOR SCIENCE AND TECHNOLOGY INSTRUCTION

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The objective of the study was to investigate the effect of concept mapping technique on students' cognitive development in Nigeria and its implications for science and technology instruction. The pretest –posttest control group design was employed in the study. The purposive sampling technique was used in selecting three out of 27 junior secondary schools that had comparable facilities. A sample of 622 junior secondary school three students was drawn from 26,303 students with stratified sampling technique. The sample consisted of an experimental and a control group. The experimental group was taught the concepts of atomic structure, acids bases and salts, energy and heredity with concept mapping technique. The control group was taught the same concepts with conventional method. Data were collected by means of Science Reasoning Tasks II with a reliability coefficient of 0.72. Three research questions were answered while two hypotheses were tested for significance. The findings of the study showed that concept mapping technique had a significant effect on students' cognitive development. The relevance of the study is that science and technology teachers should use activity-based instructional strategies such as concept mapping technique to enhance the cognitive abilities of students for improved performance in science and technology.

WHY WE NEED TO USE DRAMA TO ENGAGAGE STUDENTS WITH EIN-STEINIAN PHYSICS IN PRIMARY SCHOOL SCIENCE

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The purpose of this paper is to argue why we need to use drama structured programs constructed in collaboration with physicists and school teachers to engage students with Einsteinian physics in upper primary school science. The paper presents data from a pilot program only (n= 28), as the main body of research is yet to be conducted (n=200+). The aim is to stimulate debate within the science education community about the effectiveness of drama structured programs in facilitating the teaching and learning of Einsteinian physics in primary schools. The paper is submitted as part of the Einsteinian physics stream of the conference and will be relevant to science educators and primary school educators interested in the teaching and learning of Einsteinian physics in schools. The body of the paper consists of a literature review that supports the use of drama in science education, followed by a presentation and review of data from a pilot program that incorporated drama in an Einsteinian physics learning program for 12 year olds. The paper asserts that drama structured Einsteinian physics programs constructed in collaboration with physicists is an effective way to address concerns of student scientific literacy and disengagement with science in schools

SUPPORTING THE IMPLEMENTATION OF THE NEW ZEALAND CURRICULUM: THE NEW ZEALAND SCIENCE HUB AND EDUCATION FOR SUSTAINABLE DEVELOPMENT.

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The world leading New Zealand Curriculum (NZC) has set a direction for teaching and learning which places the learner at the centre. NZC is about young people being well equipped to become positive members of the community- national, local and global. It is underpinned by strong Values including ecological sustainability and the Key Competencies required to contribute to and be active members of society and lifelong learners. There has been a shift in New Zealand from subject focused teaching to broader education goals across a range of learning areas which gives schools flexibility to actively involve students and communities in what they learn and how it is taught and assessed. NZC recognises that students bring a wide range of skills and aspirations to their learning and they start at different points and learn at different paces. It invites schools to embrace the challenge of designing relevant and meaningful learning programmes that motivate and engage all learners. The New Zealand Science Hub developed at the University of Waikato for the New Zealand government is a resource which can support teachers to enact the curriculum in a meaningful way linked to real New Zealand science and science- related issues and to contribute to students' understanding of sustainable development. This presentation will describe the NZC and give a tour of the The New Zealand Science Hub resources that can assist in supporting teachers to design teaching programmes that meet the NZC strategic directions.

EXAMINING THE SENIOR SECONDARY SCHOOL CHEMISTRY CURRICULUM IN CHINA: IN THE VIEW OF SCIENTIFIC LITERACY

Bing Wei

The notion of scientific literacy has been advocated as the central goal in the current chemistry curriculum in China. This chapter aimed to examine the embedding of the idea of scientific literacy in the new senior secondary school chemistry curriculum. The examination was built on the concept curriculum balance and scientific literacy was defined by the four themes: (a) the knowledge of science, (b) the investigative nature of science, (c) science as a way of knowing, (d) interaction of science, technology, and society. The method of content analysis was employed to analyze the Senior Secondary School Chemistry Curriculum Standards (SSSCCS), three series of the new chemistry textbooks, and a volume of a traditional series of chemistry textbooks (prior to the curriculum reform). It was found that the issue of curriculum balance has not been dealt well in the new senior secondary chemistry curriculum with the theme of “science as a way of knowing” being heavily lacked; but compared with the traditional one, the themes of “investigative nature of science” and “interaction of science, technology, and society” have been largely added in the new chemistry books. The problem of the imbalanced distribution of the themes of scientific literacy in the senior secondary school chemistry curriculum was discussed in the final part of this chapter.

DEVELOPING THE CAPACITY OF UNIVERSITIES FOR PUBLIC ENGAGEMENT WITH STEM

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The Beacons for Public Engagement was a four year pilot programme to embed public engagement into the culture of universities in the UK. The 6 Beacons comprised 11 core universities and explored the methods for creating a more supportive culture for engagement. Aspects of the programme included: the use of high level champions within the universities; bespoke training for academics at all stages in their careers; proactively developing links with communities; funding projects that stretched the capabilities of the academics for engagement; changing the reward structures in universities; and linking academics interested in engagement with each other and with external organisations.

This workshop will present some of the main findings from the programme and then allow participants to explore the way in which these may be used in their own institutions.

REDEFINING THE ROLE OF MUSEUMS IN ADVANCING SCIENCE EDUCATION

Bryan Wunar

In order to prepare the next generation to actively contribute to a global society being shaped by science and technology, the Museum of Science and Industry (MSI) in Chicago, IL, USA established a new vision which aims to inspire and motivate our children to achieve their full potential in the fields of science, engineering, technology and medicine. To meet this challenge, MSI has reinvented the role museums can play in advancing science education in our communities and building a scientifically literate citizenry. MSI has developed a long-term strategy that provides a comprehensive suite of science education programs focused on engaging underserved youth in science learning, along with their influencers – the communities, families and schools – who support them. This paper outlines a comprehensive model for using the resources of informal learning institutions to strengthen science learning both in and out of the school setting. It explores multifaceted strategies that target students, teachers, community organizations, and families at a community-wide level, using practical and effective approaches that raise interest and participation in science by K-12 students; encourage youth to choose careers in STEM fields; sustain a supportive community climate for science engagement; and facilitate high-quality science teaching and learning in schools.

The Need for Primary Science – Its Purpose and Goals

Bulent Cavas

Dokuz Eylul Universitesi

ICASE Chair of the ICASE Standing Committee for Publications

This presentation introduces approaches to the training of primary science teachers based on a revised Turkish curriculum. The emphasis is on a more hands-on approach while introducing modern technology especially related to the use of the internet. Examples are taken from the Engineer project.

The Use of Robotics in Motivational Inquiry-Based Science Education

Bulent Cavas, Dokuz Eylul Universitesi; ICASE Chair of the ICASE Standing Committee for Publications
Abstract

Robotics is seen as intellectually rich and a student motivational approach to reaching goals in school science curricula. Robotics applications include mainly hands-on and minds-on activities that are an essential part of science teaching and learning, yet are largely being left out in many national science curricula. Robotics-based education offers students multiple opportunities to design, build and program a robot within the learning of science topics.

The aim of this presentation is to illustrate how robotics can aid a relevant approach to science learning and in this way guide teacher ownership of more relevant approaches to developing scientific and technological literacy. The specific activity is designed to show how robotics can promote learning with grade 6 students geared to:

- reflection occurs when light encounters matter;
- light is absorbed by matter as a result of interaction between matter and light;
- more light is absorbed by dark objects.

By means of a module which specifically includes a front-page, student activities, teacher's guide and further notes, the presentation reflects on the

- introductory approach (a scenario) designed to put the learning into a student relevant context. And also (very importantly) pose the issue whether such use of robotics is feasible in helping to eliminate traffic accidents.
- Points out educational (IBSE) features of the construction of robots which are able to read different wavelengths of light using a light sensor.
- Illustrates the various tests to be carried out on the constructed robots (designed as a model car) to seek ways to prevent traffic accidents.
- Discuss this (Engineering design approach) to the teaching of science in school, particularly for students in the 8-10 age range.

EFFECT OF TRICHODERMA HARZIANUM ON FIELD SCALE COMPOST- ING OF OIL PALM EMPTY FRUIT BUNCH (OPEFB)

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The increase in the demand for palm oil have subsequently also increase the waste gener- ated from oil palm industries such as oil palm empty fruit bunch (OPEFB). This waste can form a significant problem such as the contamination of the environment. Composting is an alternative in managing this waste and an environmentally-friendly way to manage lignocellulosic waste as incineration had been banned due to environmental problem. The need to turn this waste into valuable products through composting is therefore become crucial. However, composting oil palm empty fruit bunch (OPEFB) is time consuming as OPEFB contain lignocellulosic materials that are hard to degrade. The addition of benefi- cial microbes has the potential to shorten the composting period and enhance the compost maturity. In this study, *T. harzianum* was used to inoculate compost piles as it is a fast- growing fungus, has ability to suppress pathogenic fungi and can improve germination rate. One control compost pile without fungal inoculation (Compost A) and two replicates of inoculated compost piles (Compost B and Compost C) were prepared in a canvas- closed composting system. Sampling and turning was carried out weekly and parameters such as temperature, pH, moisture content, insoluble lignin content and germination in- dex (GI) were determined. Here we show that the inoculated compost pile, Compost B and Compost C both reached their maturity on Week 12 of analysis while uninoculated compost pile, Compost A reached its maturity on Week 15 which is slower than inoculated compost. Inoculated Compost B showed the highest lignin reduction. Addition of fast lig- ninolytic degrading fungus and bacteria should be taken into consideration for the future composting trial for efficient lignin degradation.

Keywords : composting, oil palm empty fruit bunch, *T. harzianum*, maturity, lignin reduc- tion.

STEM EDUCATION AS A TOOL FOR ACHIEVING THE MILLENNIUM DEVELOPMENT GOALS (IN NIGERIA)

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Stem education is not just Science Education, but about getting students to love subjects that can lead them into careers that will make them to break new grounds. The UBE programme which covers the first nine years of a child's education forms a good platform for laying stem foundations. Also, following the production of syllabuses in the national core curriculum with integrated contents and developed science projects, which propose radical changes in content, context and sequence of teaching science in secondary schools from the likes of, both CESAC and STAN is a well applauded achievement. STEM education goals will continue to gain grounds. Attaining the millennium Development Goals by 2015 which concerns eradicating extreme poverty and hunger, and achieving universal basic education, maybe feasible.

GENDER, KITCHEN RESOURCES AND STUDENTS' ACADEMIC PERFORMANCE AND RETENTION IN THERMOCHEMISTRY IN CROSS RIVER STATE, NIGERIA

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The purpose of the study was to ascertain the interactive effect of gender and teaching with or without kitchen resources on the academic performance and retention of secondary school students in Chemistry in Calabar Education Zone, Cross River State, Nigeria. The sample consisted of 120 students selected by stratified random sampling method. The pretest-posttest control group quasi-experimental research design was adopted in the study. The treatment lasted for a period of six weeks. The data collected with a 60-item multiple choice achievement test instrument were analyzed using 2x2 ANCOVA. The results indicate that there is no significant difference in the academic performance and retention of male and female students taught thermochemistry with and without kitchen resources.

EFFECT OF TEACHING WITH KITCHEN RESOURCES ON STUDENTS' ACADEMIC PERFORMANCE AND RETENTION IN THERMOCHEMISTRY IN CROSS RIVER STATE, NIGERIA.

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The purpose of the study was to ascertain the effect of teaching with kitchen resources on the academic performance and retention of secondary school students in thermochemistry in Calabar Education Zone of Cross River State, Nigeria. The sample consisted of 120 students selected by stratified random sampling method. The pretest-posttest control group quasi-experimental research design was adopted in the study. The treatment lasted for a period of six weeks. The data collected with a 60-item multiple choice achievement test instrument were analyzed using ANCOVA. The results indicate that those taught with kitchen resources were significantly ($p < .01$) superior to those not taught with kitchen resources with regard to academic achievement and retention of thermochemistry concepts.

EXTENT OF TRAINING OF LABORATORY PERSONNEL ON SAFETY MEASURES IN SECONDARY SCHOOL SCIENCE LABORATORIES IN EBONYI STATE, NIGERIA.

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The study examined the extent of training of laboratory personnel (science teachers and laboratory attendants) on safety measures in secondary schools in Ebonyi State. The researchers made use of 45 secondary schools selected through stratified random sampling while 180 science teachers and laboratory attendants were selected from these schools

using purposive sampling technique. The researchers adopted a descriptive survey design for the study. A 15-item, four-point scale and structured questionnaire was developed and used by the researchers to collect data for the study. Mean and standard deviation were used to answer the research questions while t-test was used to test the hypothesis formulated at 0.05 alpha level of significance. The result of data analysis showed that the extent of training of laboratory attendants and science teachers on safety measures in secondary schools in Ebonyi State is low. Based on the finding, the researchers recommend that the government of Ebonyi State should ensure that science teachers and laboratory attendants are trained to a very high extent on various safety measures in science laboratory and that Science Teacher Association of Nigeria, (STAN), Ebonyi State chapter should insist and ensure that the laboratory personnel are trained to a very high extent on safety measures in science laboratories.

CONSTRUCTION AND TRANSFORMATION OF ISOCHORISMATE SYN- THASE CDNA IN PLANT SYSTEM

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Isochorismate synthase (ICS) is an enzyme that involved in the synthesise of salicylic acid (SA). Salicylic acid is pathogenesis-related (PR) protein that assists in plant defense system against pathogens. In the construction, the isochorismate synthase gene is cloned into an binary vector pGSA1131. The construction was undertaken by cloning of the amplified PCR fragment of the mcICS into pGSA1131 binary vector and successfully cloned a vector with a size of 10501 base pair. The successful transformants were confirmed by chloramphenicol resistance. Subsequently, cloned vector was transformed into *Agrobacterium tumefaciens* strain LBA 4404 and successful transformants were confirmed by rifampicin and chloramphenicol resistance. *Agrobacterium tumefaciens* strain LBA 4404 is a soil plant pathogenic bacterium and mediated by T-DNA binary system which widely been used as a tool of plant transformation.

Keywords: Isochorismate synthase, salicylic acid, *Agrobacterium tumefaciens*.

APPLICATION OF NEUROCOGNITIVE THEORY IN THE CONTEXT OF SCIENCE EDUCATION

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The smell of flower, the memory of a walk in the park, and the pain of stepping on a nail are experiences that are made possible by the tissue in our body. The information recognized by the tissues will be transferred to brain. The role of brain is to interpret and response. Research related to neuroscience and ways and means of integrating these functions in improving the education is one of the recent issues discussed in the field of education. Mainly, in the context of science education, attempt has been made to intercept constructivist learning perspective with neuroscience which resulted in neurocognitive learning theory. Constructivist perspective is a major guiding theory in designing instructional method and the learning process in science education. Form the constructivist perspective, learners is viewed as actively constructing knowledge, critically reflective and creatively involved in the building of the knowledge. The constructivist paradigm is complement to the understanding of brain's function. Thus, it was reported that neurocognitive perspective would be useful to understand the active participation of the students from the constructivist paradigm. In this paper, we will conceptualize the emergent of neurocognitive theory, application of the theory in developing science instructional strategies and review of studies that have employed this theory from the perspective of science education.

THE SCIENCE EXPERIENCE: THE RELATIONSHIP BETWEEN AN INQUIRY-BASED SCIENCE PROGRAM AND STUDENT OUTCOMES

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Science education reforms in U.S. schools emphasize the importance of inquiry-based instruction. Organizations such as the National Science Foundation (NSF) had demonstrated a commitment to searching for solutions and renewed efforts to improve science education. One suggestion for science education reform in U.S. schools was a transition from traditional, textbook-based to inquiry-based instructional programs. While inquiry has shown evidence for improved student learning in science, what is needed is empirical evidence of those inquiry-based practices that affect student outcomes in a local context. This study explores the relationship between instructional programs and curricular changes affecting student outcomes in the Santa Ana Unified District (SAUSD): It provides evidence related to achievement and attitudes. SAUSD employs two approaches to teaching in the middle school science classrooms: traditional and inquiry-based approaches. The Leadership and Assistance for Science Education Reform (LASER) program is an inquiry-based science program that utilizes resources for implementation of the University of California Berkeley's Lawrence Hall of Science Education for Public Understanding Program (SEPUP) to support inquiry-based teaching and learning. Findings in this study provide empirical support related to outcomes of seventh-grade students, $N = 328$, in the LASER and traditional science programs in SAUSD.

RECENT CURRICULUM REFORMS AT THE BASIC EDUCATION LEVEL IN NIGERIA AIMED AT CATCHING THEM YOUNG TO LOVE SCIENCE, LEARN SCIENCE AND CREATE CHANGE

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The Universal Basic Education Programme was introduced in Nigeria in September, 1988. Following this, the Federal Government of Nigeria, through the Nigerian Educational Research and Development Council (NERDC) developed the 9-Year Basic Education Curriculum (BEC) by realigning all extant Primary and Junior Secondary School Curricula to meet the key targets of the UBE programme. In view of some contemporary and national concerns and to make the curriculum more practical, relevant and interest generating to the young learners, the 9-year BEC was recently reviewed with Basic Science and Technology as one of the key cluster subjects. We discuss here, the Basic Science and Technology Curriculum (Revised 2012) prepared with the aim of catching the young learner to love science, learn science and create change in the learners environment.

BACTERIA IDENTIFICATION OF SOLENOCERA SUBNUDA FROM COAST-AL MARINE OF SARAWAK

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About 3.4 million tonnes of wild prawn are caught annually globally. Prawn is now the most important internationally traded fishery commodity with Asia, which is the most important area for prawn fishing. In many tropical developing countries, prawn is the most valuable fishery export and it is the main-stay of the coastal fisheries of Sarawak. The aim of this preliminary study was to isolate, identify and characterize the bacteria from *Solenocera subnuda* in the coastal area of Northern Sarawak. The prawn samples were aseptically extruded into a sterile tube with sterile 0.85% saline. This aliquot was transferred into the next test tube and diluted serially until the dilution of 10⁻³. A 0.1ml of aliquot was then transferred aseptically onto the Plate Count Agar plates, spreaded and incubated at 29°C for 24 hours. A total of 30 bacteria isolates were collected from 3 sampling sites namely Lado, Lajang and Belawang. Biochemical tests, macroscopic and microscopic observations were carried out on the pure isolates. The prawn samples had total colony count between 4.30 cfu/ml to 1.15x10⁶ cfu/ml. Bacteria isolates found were *Enterococcus* spp. (23.3%), *Staphylococcus* spp.(16.7%), *Yersinia* spp.(13.3%), *Streptococcus* spp. (10.0%), *Bacillus* spp.(10.0%), *Corynebacterium* spp.(10.0%), *Lactobacillus* spp.(10.0%), and *Klebsiella* spp.(6.7%). If any poor processed prawns were to be consumed by human, we might be infected with microbes that may results in food poisoning. Further study should be carried out to determine the pathogenicity of these bacteria.

Keywords: Prawn, Bacteria, Biochemical Test, Food Poisoning

BIOLOGY LABORATORY MATERIAL RESOURCES UTILIZATION IN COLLEGES OF EDUCATION: IMPLICATIONS FOR BIOLOGY CURRICULUM DELIVERY IN NIGERIAN SECONDARY SCHOOLS

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In Nigeria, most Biology teachers persist in using ineffective conventional methods for teaching instead of the modern technologies available to them. This study examined the utilization of biology laboratory resources in training Biology teachers in Colleges of Education (COE) and its implications for curriculum delivery in Nigerian secondary schools. The study is a descriptive survey. A sample of 406 respondents (lecturers, students and laboratory technologists) was randomly drawn from a population of 2023. Two instruments were used for data collection. Data were analysed using mean and standard deviation. The result revealed that majority of the cheap laboratory resources like chalkboards and charts were utilized to a great extent while some expensive laboratory resources like computers, and video-taped instructions were utilized to a low extent. The implication of this finding for curriculum delivery in secondary schools is that the modern equipment, proved to generate interest and facilitate understanding of Biology concepts, will be inadequately and ineffectively utilized by teachers. Consequently, Innovative teaching methods involving modern technologies are not learnt by COE students, resulting to continued use of the conventional methods by graduate teachers. Some factors constraining the utilization of modern resources and their implications for curriculum delivery were also highlighted.

SOCIAL CONSTRUCTIVIST METHODS FOR DETERMINING STUDENTS' PRIOR KNOWLEDGE

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Learning science is not necessarily the result of teaching science. Rather, learning science is what students do with the new information they are presented with. Students are active learners who construct their own knowledge. Thus, students come to science classes with their own personal explanations and experiences of how the world works. This prior knowledge can assist, or stand in the way of, student learning. Determining students' prior knowledge is the fundamental first step in effective teaching and learning. This hands-on workshop will present a range of social constructivist methods for determining primary and early childhood students' prior knowledge: drawings and annotated drawings; concept cartoons; partial reading of a book and using puppets; graphic organiser: whole-part relationships; graphic organiser: compare and contrast; classifying and grouping; and predict, observe, explain. Participants will have the opportunity to experience each method, and discuss the benefits and limitations of using such methods in the classroom.

APPROACHES TO TEACHER EDUCATION IN SCIENCE LIKELY TO ENSURE PRESERVICE TEACHERS ARE EQUIPPED ADEQUATELY WITH THE SCIENCE SUBJECT KNOWLEDGE.

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The paper focuses on the ways in which preservice teachers can be supported to develop adequate science subject knowledge on a short post-graduate training programme. It begins with a discussion of the challenges facing teacher educators in the light of government imposed reforms on teacher education and curriculum requirements. It then describes and discusses the implications of a study that explored the perceptions of a two cohorts (n=640) of preservice teachers on a post-graduate training course. The study gauged understanding of 11 key scientific concepts at the start and end of the course and asked participants to reflect on their development of scientific subject matter by identifying those actions and factors that had helped them make progress. Firstly it was discovered that trainees' conceptual understanding had improved dramatically so that by the end of the course very few trainees had even one conceptual area that they considered a major gap in their knowledge. Secondly, the factor most cited by trainees as being influential in their development was the support provided at science workshops, although a number of other reasons for trainee development were identified. It concludes with a consideration of future course content, included blended learning strategies that are likely to be most effective in reformed structures for teacher education.

EFFECTS OF INOCULUM SOURCES ON GAS PRODUCTION IN ANAERO- BIC DIGESTION

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In this study, the biogas was produced from the anaerobic digestion of palm oil fiber (POF). Gas production was measured using the water displacement technique. Starter inocula for the anaerobic digestion were collected from palm oil mill effluent (POME) sludge and solid cud of ruminant origin. Comparisons were then made between the POME sludge and solid cud inocula, and, between inocula prepared using different ratio of POME sludge and solid cud (1:1, 1:2 and 2:1) respectively. Initial data showed that incubation using the POME sludge inoculum produced higher volume of gas at 89.5 cm³ (day 7) compared to solid cud inoculum which was at 38.0 cm³ (day 6). However, the mixture of POME sludge with solid cud at 1:2 ratio generated the most total gas volume (226.0 cm³ at day 8), as compared to the anaerobic digestion of POF using POME and solid cud, separately. We believe that further manipulation of this ratio may improve biogas production using POF as the feedstock. Ultimately, this process may assist in reducing solid residues from the palm oil factories, while at the same time; produce valuable biogases to be used in various other applications.

Keywords: Gas production, palm oil mill effluent, solid cud

LOVE LEARNING AND CREATE CHANGE IN SCIENCE AND TECHNOLOGY THROUGH EFFECTIVE MATHEMATICS EDUCATION AT THE UPPER BASIC EDUCATION LEVEL IN BENUE STATE, NIGERIA.

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It is obvious that change is the only permanent thing. This change however, require a pragmatic education to remain; and for this education to become pragmatic requires a change of attitude by learners from negative to positive especially at this era of science and technology. Science and technology is properly drive with sound mathematics. Impli- cation of this, is that adequate mathematics education is required at the foundational level of education. This paper therefore considered how improving learners' love (attitude) for learning could create change in science and technology if Mathematics education is prop- erly positioned at the basic education level in Nigeria. This is because the Nigeria nation intends to be one of the 20 economically viable nations in the world by the year 2020. It is therefore, targeted at empowering both students and teachers at this level of education, for the purpose of actualizing this very import vision of the nation. The study was carried out in Benue State, Nigeria and covered all the Universal Basic Education school students and their Mathematics teachers. Simple survey design was adopted, while instrument of study was a questionnaire called upper basic education mathematics questionnaire (UBE MQ) with 40 items. Results collate was analysed using descriptive statistics of mean and standard deviation. It was found among other things, that learners' strong love for Mathematics is a primary catalyst for actualizing the nations desire for scientific and technological development which is a basic ingredient for the nation's vision 20:2020.

IMPERATIVES OF STEM TEACHERS IN MEETING THE CHALLENGES OF BASIC SCIENCE TEACHING IN NIGERIA THROUGH REFLECTIVE TEACHING

Constant Atiatah

This paper opines effective STEM education can be achieved through reflective practice in the teaching of the basic sciences in Nigeria. It discusses what reflective thinking and reflective teaching are, models in reflective teaching, characteristics of a reflective teacher, its approaches, strategies and benefits derivable from being a reflective teacher. It postulates that if the experience, and pre-service teachers are given the chance to reflect continuously before, during and after a class, reflection can be turned to a habit which will encourage professional development as well as improve the quality of teaching.

Key words: STEM teachers, Basic Science, Reflective Teaching, Reflective Practice

HOW WELL DO TEACHERS KNOW ABOUT CLIMATE CHANGE

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The rising interest in environmental literacy and education for sustainability has created expectations that timely and accurate content should be taught in the primary, secondary as well as teacher education curriculum. This study was done to get preliminary information of the current environment knowledge of science teachers in order to produce an environmentally literate generation and provide education for sustainability in science. The instrument used is the Environmental Concern Scale containing true-false items to measure factual knowledge about Climate Change. The items consist of scientific and idiosyncratic (misconception) statements. Descriptive statistics was used in the procedure to analyze the data. The analysis of data revealed several notable misconceptions among the science teacher. The research implication is that this study is expected to increase knowledge about environmental issues and teachers will be better prepared to teach environmental issues in their science classroom. This paper will examine these issues further and recommend several measures to enhance the practice of environmental literacy in schools.

Keywords: environmental knowledge, science teachers, climate change.

**AVAILABILITY AND UTILIZATION OF BIOLOGY LABORATORY FACILITIES IN
SECONDARY SCHOOLS TO AID LEARNING IN ETHIOPE-WEST LOCAL GOVERNMENT
AREA OF DELTA STATE**

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Practical aspects of lessons aid effective problem-solving activity in Biology, improves skill acquisition of students thus influencing high achievement levels of students. The study was carried out because of need to enhance the teaching and learning of Biology in our secondary schools.. A descriptive survey of ex-post facto design was adopted for the study. The study population was all SS II students and teachers in the fourteen public secondary schools in Ethiope-West Local Government Area of Delta State. A sample of fifty-six students and seven teachers was obtained using the systematic sampling technique. A self-prepared checklist extracted from the West African Examinations Council Regulations and Syllabus for West African Secondary Certificate Examinations was used for the study. The data were analyzed using Chi-square-goodness-of-fit-test and Pearson-Product-Moment Correlation in testing the null hypotheses. Among the findings were inadequate Biology laboratory facilities in the Local Government Area since only one school had the facilities and materials; acquisition of laboratory skills is dependent on students' participation; teachers' qualification is an asset for proper utilization of the laboratory. It was therefore recommended that the Government, parents, teachers and all concerned bodies make effort to provide secondary schools with laboratory facilities, materials (specimens) and equipment.

TEACHER ASSESSMENT OF PRIMARY SCIENCE ENQUIRY IN ENGLAND

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Making valid, reliable assessments of children's scientific enquiry skills which serve both formative and summative purposes – whilst keeping the process manageable – has been a challenge for primary teachers in England since the introduction of a national curriculum in 1988. With the cessation of national science testing at age 11 in 2010 and a new primary curriculum due for implementation in 2014, the role of teacher assessment is becoming ever more central. This paper draws upon an analysis of submissions by subject leaders to the national Primary Science Quality Mark database concerning their understandings of scientific enquiry and their approaches to teacher assessment. It proposes an approach based on the use of e-portfolios to collect assessment evidence in multimodal forms (text, drawings, audio commentary, photographs, video) which can be easily linked to assessment criteria by both teachers and children and provide outputs for formative and summative purposes. This approach is being developed with a cluster of primary schools in South West England, drawing upon the task-based approach of Project e-scape (e-solutions for creative assessment in portfolio environments), whilst broadening it to provide greater pupil control over the ongoing collection of assessment evidence. Early findings will be reported.

EINSTEIN FIRST, NEWTON SECOND: TEACHING PHYSICS FROM A MOD-ERN STANDPOINT

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This paper summarises the rationale and the methodology for a radical overhaul of the approach to teaching physics to student's years 6-12. Using examples we show that the core concepts of Einsteinian physics—quantum mechanics and general relativity can be comprehended by school students, and even by students for whom this is their first contact with both physics and geometry. We summarise pilot studies that confirm that modern physics can be made accessible to young students. An important aspect of this approach is the means by which the useful approximations of Newtonian physics can be introduced after exposure to Einsteinian physics.

THE INTERNATIONAL BACCALAUREATE DIPLOMA SCIENCE PROGRAMME

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Description of The International Baccalaureate® (IB) as a high quality program of international education to a worldwide community of schools, the IB Diploma program as a 16-19 years program for university entrance, with a particular focus on group 4, the science courses of the Diploma program, Physics, Chemistry and Biology (also briefly, the other group 4 subjects - Environmental Systems and Societies, Sports, Exercise and Health Science, Computer Science and Design Technology.) This will include the course structures, the curriculum and assessment models and subject content. Details of the assessment, both internal and external examinations will be given and novel features of the course emphasized. There will also be an introduction to a new science course being developed and how curriculum development in general is undertaken in the IB diploma programme. For each of the above there will be references to issues and challenges to the IB.

Keywords: International Baccalaureate, diploma program, science courses, high stakes, criterion referenced.

THE ROLE OF INVESTIGATIONS IN PROMOTING INQUIRY-BASED SCIENCE EDUCATION IN IRELAND

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This paper describes recent developments in Ireland to promote a greater interest in science among students in the 12 – 15 age group by means of practical work involving Inquiry Based Science Education (IBSE). The tasks, known as Investigations, are a component of the assessment of the subject Science which is studied as part of the Junior Certificate examination for 15 year-old students. The introduction of Investigations has been one of a number of responses to the 2002 report of a government Task Force on the Physical Sciences, set up to consider the problems facing the teaching of the physical sciences in second-level schools in Ireland. This report has resulted in rapid reform of the science curriculum at both junior and senior secondary school level. Whilst practical work has a long and varied history in science education in Ireland, it was only in 2003 that practical work became compulsory with the introduction of a new Junior Certificate science syllabus for students in the 12 – 15 year old age group. The paper describes the two types of practical work introduced in the syllabus and discusses the results of a survey carried out by the Irish Science Teachers' Association to ascertain the response of teachers to this practical work and the role of Investigations in promoting IBSE in Ireland.

EFFECTIVENESS OF AN ICT BASED CONSTRUCTION TASK ON THE LEARNING OF MOON PHASES

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One popular non ICT based construction activity especially in the science classroom is the use of Student Generated Drawings (SGD) (Van Meter & Garner, 2005). As technology becomes more available to students, whether in the school or at home, many teachers have attempted to incorporate ICT based construction tasks in learning. Some popular examples include hypermedia, electronic portfolios and digital videos. Student created videos or animations can be considered digital equivalents to student generated drawings. The major difference is that student created videos or animations are much more time consuming but tend to offer sustained engagement as compared to student generated drawings. In this study, Slowmation (Hoban, 2005), a form of student created video task was used. The purpose of this study was to investigate the effectiveness of Slowmation, given as a construction task in the learning of moon phases. Slowmation was compared to student generated drawings in terms of instructional efficiency and perceived motivation. The learning was done within the context of a self-directed learning activity in an online learning mode by pre-service student teachers.

THE INNOVATION EQUATION: 9 KEYS TO IMPROVING STEM EDUCATION IN OUR SCHOOLS AND COMMUNITIES

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The best way to ensure success in Science, Technology, Engineering, and Math (STEM) education reform is to be sure that all stakeholders understand the reasons why reform is necessary and to work together to outline the ultimate goals of the initiative. From this shared vision, school and community leaders can focus on how best to shape the design of a STEM education initiative. Based on research gathered from school, districts, this workshop introduces a framework for improving STEM education in schools and communities around the world. The Innovation Equation explores what school officials, educators, and policymakers need to know in order to better prepare young people for the 21st Century. Building on research collected from hundreds of STEM professionals and interviews with the leaders of over 50 innovative STEM initiatives from around the world in the US, this presentation outlines 9 keys to success when implementing a STEM education initiative. In profiling passionate STEM educators and leaders, Laboy-Rush reveals how the collaborations with industry leaders provided the intellectual capital and support for significant improvement in student engagement and performance. Laboy-Rush identifies patterns that form a playbook for leaders with a mission to improve STEM education in school systems and communities worldwide. Collaboration, inspiration, design thinking, and inclusiveness are just some of the keys to improving STEM education in our schools and communities. The presentation documents some of the most innovative STEM initiatives around the world, where individuals are going against the grain in education and seeing phenomenal results.

BACTERIAL PIGMENTS FOR DYE-SENSITIZED SOLAR CELL (DSSC) APPLICATIONS

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Solar energy is the best known replacement to the currently high-costing and environmental polluting fossil fuel. In Malaysia, the weather provides best available sunlight that enables the application of principle of photosynthesis for Dye-Sensitized Solar Cell (DSSC) use. There have been numerous reports on the use of natural pigments extracted from plants and fruits as sensitizer of these sunlight harvesting cells. However, the use of plants and fruits are impractical due to the high cost and low availability. Thus, this project aims to investigate the potential of bacterial pigments isolated from colored bacteria for DSSC applications. The pigmented bacteria will be isolated and identified using polymerase chain reaction (PCR) analysis and DNA sequencing and bacterial pigments will be extracted and characterized using thin layer chromatography and spectrometry analyses and further identified using mass spectrometry (MS) and Nuclear Magnetic Resonance (NMR). The bacterial pigments isolated will be tested through the fabrication of a simplified DSSC.

THE CURRICULUM DEVELOPMENT IN “SCIENCE-POPULARIZATION IN JUNIOR MIDDLE SCHOOL”

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Science popularization, understood from its natural property, refers to the non-disciplinary education and communication of science and technology. Since it is better to start the education of science popularization at an early age, Beijing Youth Science & Technology Club organizes volunteer schools to carry out the experiment. High School Affiliated to Renmin University of China (RDFZ) is one of the most active schools. The program of “Science-popularization in Junior Middle School” has been operated since 2008 in RDFZ as an experimental activity of fundamental quality education. Our key teaching goal is to help students understand how to popularize science by encouraging them to “Learn Science, Be Fond of Science”. In the implementation process, we gradually improve the curriculum system of the program. At present, this course accumulated a certain amount of curriculum resources with the efforts of teachers. Moreover, a relatively comprehensive student assessment system has been built to support the operation of the program. This paper presents the curriculum development of this scientific literacy-targeted program in detail.

DEVELOPING A CRITICAL EYE FOR READING MEDIA REPORTS OF SCIENCE: RESOURCES FOR AN INTERDISCIPLINARY APPROACH TO CRITICAL READING

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Science reported in the media is a resource that many science teachers exploit as a means to develop science literacy through critical reading of science-related news. Science news is also used in other curricular areas. It represents common ground between teachers of science and English (mother tongue) and is therefore an authentic context in which to explore the challenge of interdisciplinary learning. This workshop will be of interest to teachers and teacher educators. It is based on the findings of studies that explored the aptitude and capability for critical reading of science-based news reports by teachers of science and English and interdisciplinary curricular development aimed at promoting critical reading of science news. Teachers displayed traits in critical reading that were characteristic of their subject background. These differences provided impetus for collaborative work. Media resources are abundant but difficult to exploit effectively. Students experiencing science news in different subjects are exposed to teachers of science and English (mother tongue) who think differently about critical reading, the challenge is to integrate different perspectives to enhance and enrich student learning by developing appropriate pedagogies. The materials and strategies developed by teachers for use in the classroom are explored in this workshop.

TEACHING WITH SCIENCE IN THE NEWS: AN INTERDISCIPLINARY APPROACH TO PROMOTE CURRICULUM AND PROFESSIONAL DEVELOPMENT

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This study describes a secondary school based curriculum development project involving science and English teachers focusing on critical reading of science related news. The outcomes will be of interest to teachers, teacher educators and those responsible for curriculum development. Responding critically to science in the news is recognised as one aspect of science literacy consequently, it is a useful resource for teachers wishing to develop students' capability to read and respond critically to media reports with a science component. English teachers too are concerned to promote critical reading and increasingly recognise the value of science news for this purpose. Hence science news provides an authentic context for teachers of science and English to collaborate in promoting interdisciplinary learning. The challenge of cross-curricular collaboration highlights the professional development needs of both science and English teachers in this context. The study reports the impact on teachers' professional communication, curriculum planning and classroom practice. It explores the advantages of increased professional discourse that addressed pupils' learning, and the value of peer reviews that showed considerable insights and stimulated reviewers' personal reflection. It also showed that teachers' appreciation of cross-disciplinary subject knowledge needed for critical reading was tentative and limiting.

ARDUINOS IN SCIENCE EDUCATION: A WESTERN AUSTRALIAN EXPERIENCE

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A quiet revolution in instrumentation has occurred over the past five years, as cheap, mass produced, Open Source microcontrollers have come onto the market. This has fuelled an explosion of DIY projects and produced an extremely active, capable and accessible community of hobbyists and volunteers, which has some profound implications for Science Fairs and other extension projects run by educators. As a consequence, school teachers have done everything from launching near-space high altitude balloon missions, built thermal imaging cameras, and all kinds of robots and sensors. This workshop will explore some of the implications of this exciting technology, while focussing on some of our experiences in Western Australia, and allow attendees to explore some of this equipment.

CREATING CHANGE THROUGH INTEGRATION OF INDIGENOUS KNOWL- EDGE AND PRACTICES INTO CHEMISTRY TEACHING FOR SUSTAINABLE LIVING

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Chemistry is an important and everyday science that requires varieties of teaching strate- gies that can enhance understanding and application for sustainable living. Consequently, stakeholders in chemistry has been concerned with effective methods of teaching chemistry at secondary school level that can change secondary school students attitude towards the subject and enhance achievement and understanding. This paper, therefore, tried to de- termine the influence of integration of indigenous knowledge and practices into chemistry teaching on academic achievement of students. The results showed positive influence of the method on students achievement although no significant influence was found on gen- der. Also the interaction effect was not significant and it was advocated that this be done for effective teaching and learning of chemistry.

INQUIRY BASED SCIENCE EDUCATION (IBSE) IN BRUNEI DARUSSALAM: FINDINGS OF 5 YEARS PROGRAM REVIEW (2008-2012)

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IBSE was introduced in 2008 based on French example of La main á la pâte

IBSE is radical systemic change to teach and learn science

Rationale: To meet SPN21 goals to prepare students to live meaningful life a in this complex society and to become citizens of the world

Target: All Science teacher in Brunei to receive IBSE Training / adopt inquiry approach teaching & learning skills

TRENDS IN PRIMARY SCIENCE A DECADE ON

Dr. Gregory Smith
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This research uses a 'trend study' methodology to investigate trends in scientific literacy over the past decade. The study uses samples of year six and seven primary student perceptions of science classroom practice in 2001, 2007 and 2011. The past decade has seen research, reports, recommendations, professional learning programs and State and Territories based science curriculum documents addressing scientific literacy and effective science classroom practice. At a time when science teaching is undergoing considerable change with the implementation of the new Australian Science Curriculum a study of the trends in primary science classroom practice provides 'points in time' data as a space for reflection on a decade of scientific literacy. The study concludes there has been little change in students engaging in the active exploration of phenomena, ideas and relevant science questions or the use of open - investigations. However, the nature of the classroom is trending towards being more collaborative. There has been a dramatic increase the trend of using the internet and computers for science learning.

BUILDING STEM EDUCATION WITH MULTINATIONALS

**Dr. Lauren B. Birney and Dr. Jonathan H. Hill,
Pace University STEM Collaboratory 2013**

STEM Education is commonly defined as the interdisciplinary teaching and learning of science, technology, engineering, and mathematics to a level of rigor sufficient to produce critical thinkers and problem solvers across all disciplines in this endeavor. It has become accepted that the American educational pipeline is not presently equipped to provide the skills necessary to meet the demands of the STEM workforce. Lack of school resources, deficient support in the content areas, and the isolation of the teacher are all contributing factors. As a result, the K-12 educational system is not sending enough students into the college ranks with the preparation necessary to be successful science and math students, a trend reflected in the global achievement gap (S DCOE/LEA, 2010).

And the situation is only becoming more critical. By 2016 the 10 fastest growing occupations in New York State will require STEM competencies (New York State Department of Labor, 2010). Furthermore, the rapid growth of jobs in STEM-related fields such as biotech, computer science, information technology, telecommunications, medicine, and pharmaceuticals has coincided with the realities of an aging workforce and unacceptably low percentages of women, Hispanics, and African Americans in the STEM workforce.

Pace University seeks to address these issues by partnering with teachers and students in New York metropolitan area schools to improve STEM teaching and learning. Over the past few years, STEM faculty from across Pace have come together to develop relationships with several underserved, diverse public schools in the New York region. Altogether, the schools reach nearly 5,000 students between Pace University faculty support teachers and students at these schools through: faculty/teacher mentoring relationships; curriculum development; creation of inquiry-based projects for students; and teacher training and development.

Pace University's work with K-12 school partners employs the STEM Interdisciplinary approach to learning, defined by the coupling of rigorous academic concepts with heuristic lessons that students can apply to the content areas of Science, Technology, Engineering, and Mathematics. Students are then able to use this information to make connections between school, community, work, and the global enterprise, enabling the development of STEM literacy and with it the ability to compete internationally (Tspuros, 2009). STEM Inquiry-based learning support at several of our partner schools has indicated that providing these resources will increase interest in STEM fields, provide sufficient teacher support, and create innovative resource opportunities for schools.

As a dynamic and innovative University that is responsive to the intellectual and professional challenges facing our City, region, and country, Pace University intends to address the dramatic needs in STEM - Science, Technology, Engineering, and Math education by establishing the Pace University STEM Collaboratory. The "Collaboratory" will facilitate interdisciplinary research and the exchange of ideas among students, faculty, and staff in STEM disciplines from across the University. Program Goals:

- Identifying and developing a pipeline of STEM students and teachers in the greater New York area in grades 6 – 12;
- Integrating STEM best practices in the preparation of workforce-ready students at the college level;
- Increasing the proficiency of specially selected grade 6 – 12 teachers and administrators in STEM teaching;
- Developing ways to motivate learners to persevere in the study of science, technology, engineering, and math; and
- Launching an interdisciplinary STEM research group based at Pace University that will be a clearing-house for successful initiatives in STEM education.

WEATHER, CLIMATE, WEB 2.0: 21ST CENTURY STUDENTS SPEAK CLIMATE SCIENCE WELL

Dr. Teresa Kennedy, University of Texas at Tyler, USA

Hybrid teacher professional development models using 21st century tools for social collaboration have been studied for the past 2 years as a part of the “From Learning to Research” project funded by the U.S. National Science Foundation. Exemplars of participation by the K-12 students in the citizen scientist component of the project are described, including illustrations of recognition by the local/global community of the contribution of the students to reducing anthropomorphic impact on local ecosystems.

TEXAS STEM CENTER COALITION TRANSFORMS TEACHING AND LEARNING METHODS

Dr. Teresa Kennedy, University of Texas at Tyler, USA

The Texas Science, Technology, Engineering and Mathematics (STEM) Centers address the challenges of tomorrow's technology-driven economy by researching, developing, and supporting best practices in STEM education for K-12 schools. The Texas STEM Center Coalition works with T-STEM Academies as well as all Texas schools to transform teaching and learning methods, improve achievement in STEM education, and ensure all students are college-ready, career-ready, and life-ready. This presentation highlights the seven centers that are part of Educate Texas and describes projects underway.

IMPACT OF ALL STAR SCIENCE EXPO IN URBAN SCHOOLS

Dr. Zsuzsa Marka
Columbia University in the City of New York

Urban schools with a close proximity to universities, colleges and other forms of higher education often have a high proportion of scientists in their parent body. The School at Columbia University is a lottery-based school, in the City of New York with a diverse student body. Fifty percent of the students come from Harlem, Morningside Heights and the Upper West Side, while the other half has parents –many of them are scientists - who work at Columbia University. Our Science Expo, started in 2010, is a biennial event originally initiated by volunteering scientist parents, and it is supported by the school’s administration. Our goal is to introduce cutting-edge science concepts on a fun hands-on way to children, and make the kids realize that science is exactly what they are already good at: inquiry, curiosity and exploration. On the day of the event, the school is transformed to a six-story, hands-on science museum, with each classroom illustrating different research topics. Enormous amount of work goes into planning the event, since our goal is to have a school-wide attendance, by children from all socioeconomic backgrounds. The scientists are paired with the school’s science teachers who provide expertise in presenting complex scientific concepts to a young audience. In this talk, Dr. Zsuzsa Marka, Associate Research Scientist at the Columbia Astrophysics Laboratory, and co-chair of the Science Expo series at The School at Columbia University will present her experiences and lessons learned in this exceptional parental initiative. Many urban schools have unique resources in their parent body, including scientists who - by their curious nature-will happily volunteer for similar initiatives, and bring cutting-edge science to schools for everyone!

EFFECT OF EXPOSURE TO CONSTRUCTIVIST INSTRUCTION ON INTEREST OF MALE AND FEMALE SCIENCE STUDENTS.

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The study investigated the effect of exposure to constructivist instruction on interest of male and female science students. Quasi-experimental of the pretest- posttest non equivalent control group research design was used. Three research questions answered using Mean and Standard Deviation (SD), and three hypotheses tested at .05 level of significance using ANCOVA guided the study. The subjects were 162 Upper Basic secondary two students from four intact classes, selected by purposive sampling of four schools, out of 23 coeducational JS schools in Ohafia L.G.A., Abia state, Nigeria. Four schools were randomly assigned two each, to constructivist instruction and traditional (lecture method) groups. Instrument for data collection was Basic Science Interest Inventory (BSII), a four point rating scale response options. BSII had 30-items validated by four science educators in UNN. The reliability was established using Cronbach Alpha and an internal consistency of 0.98 was found. Students' regular teachers exposed to training handled the teaching. The major findings were that students exposed to constructivist instruction developed higher interest in science than those exposed to lecture method. There was no significant difference between the compared mean interest scores of male and female students. Constructivist instruction was superior to lecture method irrespective of student's sexes. Recommendations were made.

LEGO MINDSTORMS NXT 2.0 BASED LEARNING ENVIRONMENTS ARE EFFECT OF SCIENCE PROCESS SKILLS OF STUDENTS

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The aim of this study is to investigate the impact of a Lego Mindstorms based Robotics, operated as in school but intended for the future within the primary science and technology curriculum, on sixth grade students' science process skills and attitudes toward science and technology. The Robotics based science education introduced robotics and robotics programming through Lego Mindstorms NXT 2.0 and introduced inquiry-based robotics activities related to socio-scientific issues (involving structured, guided or open inquiry). Participants in this study were thirty-sixth grade students, who were randomly selected among all sixth grade students at a state school in Izmir by a committee of science and technology teachers. The students worked collaboratively in groups, and were guided to undertake scientific inquiry using technological designs and robot programming. This paper explains how the robotic activities is organized in the light of constructionism theory and a three stage teaching approach, which kinds of process skill activities it includes and an evaluation of how it encourages students to think as a scientific problem solver on real world tasks. The result of this study show that the Robotics increased students' science process skills and developed their attitudes.

Key words: Science and technology education, robotics, science process skills, attitudes

GROWTH RESPONSE OF TOMATO PLANTS TO FUSARIUM OXYSPORUM AND BOTRYODIPLODIA THEOBROMAE INFECTIONS

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Two fungi *Fusarium oxysporum* and *Botryodiploda theobromae*, were isolated from infected tomato fruits obtained from Abasi Obori market in Calabar, Cross River State, Nigeria. Symptoms were manifested in plants five days after inoculation with *F. oxysporum* and seven days with *B. theobromae*. Plants in the control (inoculated with sterile distilled water) were observed to exhibit health growth. A significant ($p < 0.05$) reduction was recorded in the heights of plants infected with the test pathogens compared to those in the control particularly from the third week of the experiment. *Botryodiplodia* and *Fusarium* infected plants recorded heights of 25.26 and 24.60cm respectively compared with 38.43cm observed in plants in the control three weeks after inoculation. A reduction in number of leaves per plant was also recorded in infected plants after six weeks. Plants inoculated with *B. theobromae* lost 6 leaves while those inoculated with *F. oxysporum* lost 8 leaves within six weeks. Inoculated plants with the two pathogens also recorded significant ($p < 0.05$) effects on their fresh and dry weights when compared to the controls. The difference in dry weight between the treatments and the controls were 7.65g and 8.33g in *B. theobromae* and *F. oxysporum* infected plants respectively. The values for the fresh weights (40.0g for *B. theobromae* and 31.7g for *F. oxysporum*), were significantly ($p < 0.05$) different from those of the controls (70.0g). Leaf discoloration was also observed on infected plants while leaf surfaces were covered with greyish white fungal mycelia. The symptoms observed in this study are synonymous with those of wilting.

Keywords: *Fusarium oxysporum* and *Botryodiploda theobromae*, tomato, infection.

ENVIRONMENTAL ATTITUDES AND ENVIRONMENTAL BEHAVIOR – WHO IS THE HORSE AND WHO IS THE CART?

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Early models of environmental education, beginning in the 1970s, assumed some type of linear relationship between attitudes and behavior, where: (a) positive attitudes lead to positive behavior; and (b) positive behavior is perceived as an ultimate goal of environmental education. Through continuous research, the linear model of relationships was proved wrong. Yet, while the idea of a ladder steps has subsided, the perception of acquisition of environmental behavior as an ultimate goal of the educational process has maintained a strong hold in the environmental education community. The presentation re-opens the question of the relationships between processes of influence on environmental attitudes and on environmental behavior and questions the taken-for-granted approach in which acquisition of environmental behavior is perceived as a 'higher' and more desired achievement compared with acquisition of environmental attitudes. Results of two studies conducted in Israel will be presented and discussed. The two studies implement two different methodologies with two different samples for examining influences on adults' environmental attitudes and behaviors. Both studies demonstrate that attitude formation stems from a person's most intimate past and present experiences, which form a part of one's self identity, whereas, behavior is more influenced by non-personal formative influences. It was found that in contrast to behavioral changes which were relatively easy to elicit, attitudinal changes emerged as more complex cognitive and affective processes that are slower to develop.

AN INDEX FOR MEASURING THE LEVEL OF COMPLEXITY OF SCIENTIFIC INQUIRIES: THE INDEX AND ITS RELATIONSHIP WITH METACOGNITIVE ACTIVITY

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Throughout the past four decades the importance of students performing complete authentic scientific inquiries, has been emphasized as a major pillar in science education. The presented study focuses attention to aspects of the inquiry processes, as opposed to the inquiry procedural outcomes. The following two questions are put forward with regards to scientific inquiry processes: (a) how can scientific inquiry be measured in terms of the processes, rather than merely by the procedural outcomes? And, (b) what is the relationship between the amount of complexity of the inquiry process and the amount of the metacognitive processes that are carried out throughout the inquiry process? For answering the above questions, a simple quantitative index was developed for measuring some major qualitative aspects of the inquiry process. These aspects include the number of deviations from a linear straightforward inquiry process and their magnitude. The index also provides indication regarding the level of metacognitive processes that take place during the inquiry process. Online documented internet discussion protocols of teams of high school students conducting complete authentic scientific inquiries, were used as data sources. For each team we derived a Level of Complexity of Complete Inquiry (LCCI) index measure. We then calculated the level of metacognitive activity for each of the teams. A striking correlation ($r=0.971$, $p=0.006$) was found between the LCCI index and the level of metacognitive activity that took place during the inquiry processes.

THE DISCRIMINATION AGAINST AND EXPLOITATION OF WOMEN AT GLOBAL LEVEL

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The paper highlighted the discrimination against and exploitation of women at global level. Efforts made at global level in promoting gender equality in education and employment opportunities through gender mainstreaming were discussed. Women and girls under representation in universal basic education which is the basis for science and technology education in Nigeria were discussed and instructional strategies for mainstreaming gender in universal basic education classrooms in Nigeria were highlighted. Some recommendations were made among which were that government should set up a programme in each state of the country to address such gender issues on inequality in science and technology education and discrimination in employment opportunities. Furthermore, that teacher educators should incorporate strategies for mainstreaming gender into the pre-service teachers education programme.

TURTLE WATCH: COMMUNITY PARTICIPATION AND ACTION

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Community members make important contributions to conservation through participation in citizen science projects. Turtle Watch is a citizen science project conducted in the Perth Metropolitan Area of Western Australia. The target species was the oblong turtle, *Chelodina oblonga*, which inhabits the wetlands of Perth and are under threat from habitat loss, road deaths, predation and climate change. Nest predation issues arose during stage 1 of Turtle Watch (2006-2008), so Turtle Watch 2 (2010-ongoing) aimed to identify predators and foster community partnerships to promote awareness and conservation of turtles. The project includes four eco-education centres and involves government and community groups concerned about turtles. Camera surveillance was undertaken to determine predators. Numerous strategies were adopted to promote community awareness and participation, including, public talks, fair stalls, media publicity, and the 'Turtle Hotline' and ClimateWatch website for recording turtle sightings. Results included camera surveillance evidence of fox predation, however, surveillance processes were found to be complicated. Numerous partnerships, ranging from research organizations, educational institutions, and input from community citizen scientists associated with Friends groups, made valuable contributions to the project by working collaboratively on turtle conservation issues. Such cooperation contributed to improved knowledge, skills and action in relation to oblong turtle conservation.

ASEI-PDSI APPROACH TO THE TEACHING OF BASIC SCIENCE AND TECHNOLOGY IN PRIMARY SCHOOL

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The paper advocates ASEI-PDSI approach considered to be significant in the teaching and learning of Basic Science and Technology in primary school. The approach which is not a new method rather than an innovation in strategy emphasises activity-based, learner- centred and participatory teaching and learning process. The paper enumerates the features of ASEI-PDSI approach, ASEI lesson plan and points to consider in preparing and implementing ASEI lesson. The merits of the approach, challenges and how to manage the challenges to enhance teachers and pupils performance in Basic Science and Technology were discussed.

SCIENCE DRAMA: CLUE TO UNDER ACHIEVEMENT IN SECONDARY SCHOOL CHEMISTRY?

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Persistent low and under achievements in secondary school science generally and chemistry in particular, is a threat to technological developments of nations. Teaching and learning methods that could enhance achievements must be explored in order to address the problem globally and more so in developing countries. The present study investigated the effects of incorporating science drama and culturally relevant analogical concepts in secondary school chemistry classrooms on the achievements of average mental ability students. A three by three equivalent group, pre-test/post test experimental design was employed. Subjects were sampled from three school types– Boys, Girls and Mixed. Conventional teaching method groups formed the control. Both groups were taught a chemistry topic for six weeks and given post-tests thereafter. AN- COVA was used to analyze data collected. Results showed that the drama groups achieved a total average score consistent with their mental abilities (48.19) while the conventional method group could not (37.21). The difference was significant. There was also no significant difference in the achievements of students from Girls' Schools and those from Boys' Schools who were taught by incorporating science drama and analogies. School systems, especially in developing countries were advised to adopt science teaching methods that incorporate culturally oriented drama and analogies in tackling under achievements and male-female achievement disparities in science.

INNOVATIVE PRACTICAL ACTIVITIES IN SCIENCE AND TECHNOLOGY IN SOUTH-SOUTH GEOPOLITICAL ZONE OF NIGERIAN UNIVERSITIES FOR SUSTAINABLE ECONOMIC REFORMS

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The paper practicalizes creative valuable innovative science and technology practical activities in South-South Geopolitical zone of Nigerian Universities for sustainable reforms. Review of related literature has shown that majority of science and technology teachers lack essential skills to impart and apply practical activities effectively during teaching; hence students come out of school ill-equipped and half-baked to face the world of work because the needed competence is lacking. A pretest-posttest-non-randomized experimental design is thus adopted for the study. The population comprised year 1 and year 2 science and technology students from all the 9 Universities in South-South Nigeria. A stratified random sampling technique was used to draw 164 students of science and technology in four selected Universities which formed the sample for the study. Two universities were exposed to creative valuable innovative science and technology practical activities while the remaining two were taught using Lecture method. Creative practical skill test on thermodynamics (CPST) was the instrument used to collect data before and after each lesson. A t-test analysis showed significant difference of 13.10 in post-test performance of science and technology students, exposed to treatment using iconic instructional kits (with higher mean score) benefiting significantly higher than students in the control group. Creative and innovative value – laden practical activities for science and technology classes are recommended for students practical skills and knowledge acquisition for science and technology.

BUILDING BLOCKS FOR FUTURE ASTRONAUTS USING MOON PHASE PROJECT

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The purpose of the study was to use the Moon Phase project to develop in high elementary children interest in astronomy, improve their inquiry skills of observation, recording and use their findings to make predictions. 10 groups of 40 high elementary school children were used for the project with 50-50 representation of boys and girls. Each group was to keep track of the Moon phase for the months of March, April and May and use their record to predict whether Easter and/or Christmas 2012 will be celebrated with moonlight or not and make a poster presentation of their predictions to member of the club. The presentation was scored excellent (for correct recording and drawing with adequate verification of their prediction), good (correct record and drawing but lack adequate verification of their prediction and lacking (improper daily track of the moon phase). Findings showed 4 groups scored excellent, 3 groups scored good while 3 groups scored lacking. The project removed the abstraction in the study of solar system, promote children's scientific literacy and develop their interest in astronomy as well as improve their inquiry and communication skills. An innovative teacher can implore this method to teach any class size and concept especially difficult concepts in science.

INCREASING FUN IN SCIENCE TEACHING AND LEARNING BY MEANS OF POEMS AND SONGS

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Science remains one of the most important subjects in school curriculum, but it has failed to excite more students. This situation could be as result of the way science is being taught especially at the basic level often as rote memorization of complex facts and abstract data more or less as an obligatory activity not taking the learners interest into cognizance. This situation therefore, poses a challenge to science educators to investigate the efficiency of the employment of methods of communicating science in a fun and relaxed manner that could increase students' interest. In this paper efforts are being made in reviewing existing literature on the potentials of poems and songs as a means of communicating science concepts which are likely to increase interest and promote understanding that could enable the learners to get into the subject and see its relevance to their lives and their world.

EMPLOYING COMEDY AND SOCIAL DRAMA MOVIES AS TOOLS FOR THE PROMOTION OF SUSTAINABLE LIVING IN AFRICA

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In Africa, science, technology and mathematics (STM) taught in the classroom have failed to yield the desired result of solving the socio – scientific issues that affects sustainable living in Africa due to the various challenges confronting science technology and mathematics education (STME) and also due to the fact that much of the African population that contribute to the socio – scientific problems of Africa live in remote rural areas without education or not scientifically informed. Therefore, in as much as STM educators see the need to promote and enhance STME in Africa, they should also find a means of producing active and participating citizenry. This is because solving the socio – scientific problems of Africa is far beyond the efforts of African governments, STM educators, scientists, technologists or engineers in Africa. It requires the collaborative efforts of Africans as a whole. Africans are cultural people with high affinity for humor and entertainment. Therefore, through their love for entertainment one can create a means of educating them on positive practices that could solve socio – scientific problems and promote sustainable living. The paper review existing literature on the importance of living. The paper review existing literature on the importance of comedy and social drama movies produce and played by Africans in the local languages and customs of Africa, in the dissemination of science information that could create awareness and result to attitudinal change towards solving the socio – scientific problems of Africa for sustainable living. Therefore, the national cinema of African countries through close relationship with stakeholders in education and the culture of the countries can be utilize in reaching the educational and developmental goals of the countries.

EVALUATION OF MICROBIAL WATER QUALITY OF SWIMMING POOLS IN KUCHING AREA

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Swimming pool has a high probability of becoming a transmitter of foodborne or water-borne diseases among users. Microbial water quality is assigned as monitor to the safety of consumers using the pool with the lowest chance of infection. UNIMAS Competition Pool, Boulevard Kids Recreational Pool and MBKS Public Swimming Pools were selected as study site for the microbial water quality whereas *Escherichia coli* and *Vibrio cholera* are selected as contamination indicator of swimming pool water. Spread plate technique was used to enumerate the microbial distribution. Biochemical tests were also conducted to confirm the presence of the indicator bacteria. PCR was conducted for confirmation test of *V. cholerae*. *E. coli* was found to be positive in 3.57% of water samples from UNIMAS with 1.888×10^4 CFU/mL, 3.33% of water samples from Boulevard with 1.718×10^8 CFU/mL and 2.78% from MBKS with 7.900×10^8 CFU/mL. However, the result does not affect the safety of all the swimming pools. There was no *V. cholerae* found in all water samples obtained in Kuching. Physiological parameters did not showed significant relationship with the microbial indicators distribution in water samples.

COMPARATIVE STUDIES OF SCIENCE EDUCATION CURRICULA IN JAPAN AND THE PHILIPPINES

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This research compared science education curricula in Japan and the Philippines. Science education as a major subject in both nations begins in third grade in elementary school. Science subject in Japanese compulsory education is simply called Science. In the Philippines, science subjects in elementary and high schools are known as Science and Health, and Science and Technology, respectively. In the Philippines, the science curriculum for secondary education is decided. In contrast, high school students in Japan can elect science subjects in accord with their future course after graduating from high school. Time allocation for science education in each grade level is different in Japan and the Philippines. A number of topics specific to each country were also found.

Key words: Science Curriculum, Japan, the Philippines.

SOIL CARBON SEQUESTRATION: MITIGATING CLIMATE CHANGE THROUGH GRAZING METHODS. PLUS CREATING THOSE, NOT ONLY THROUGH GEOGRAPHY LESSONS, BUT ALSO THROUGH AN HOLISTIC EDUCATIONAL APPROACH

Fettes Falconer

This 'workshop' will, in the main, be an information session ending in question and answer. And, hopefully, I will be able to answer your questions on a system in which I have long held an interest.

The system is called Holistic Management, developed by Allan Savory, a fellow countryman of my birth; Rhodesia/Zimbabwe.

The core competency in Holistic Management is the reversal of land degradation/desertification in the world's grasslands and savannas through sustainable grazing methods developed by Savory. It is now practiced by a growing number of land, livestock and wildlife managers around the world.

On a recent visit to a remote cattle station in The Kimberley I observed the successes of the Henggeler family in restoring degraded land, and sequestering soil carbon, using Savory's sustainable grazing methods.

Too often the curricula of Geography and Earth and Environmental Sciences focus on gloom and doom issues and not on practical solutions. Education should produce hope, not gloom and doom.

I wish to also show how educating for sustainability is not the just the domain of Geography/Science. To successfully promote hope and sustainable behaviour the holistic across-the-curriculum approach needs to be adopted.

NSANGU TREE (ACACIA ALBIDA/ACACIA TORTILIS) LEAVES AS A BETTER SUBSTITUTE FOR ARTIFICIAL FERTILIZER – COMMUNITY SCIENCE TO REDEEM MALAWI OF FERTILIZER CRISIS.

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Low crop yields associated with predominantly nutrient-related soil constraints to crop production constitute an undoubted characteristic of subsistence cropping systems throughout Malawi. To address this problem, over the past years, several agricultural reforms have been undertaken by the government, including: the targeted input programme (TIP), promotion of organic manure, small scale irrigation schemes, and currently, the Targeted Fertilizer Subsidy Programme (ICRAF 2004). Most of these initiatives however have only targeted a few farmers, the latest being the Farm Input Subsidy Programme (FISP) which targeted only 1.4 million people and have increased on food insecurity. Due to the increased prices of these inputs, it becomes very difficult for smallholder farmers to afford to buy them. To solve this problem, different initiatives are being derived one of which is the use of fertilizer trees. Nsangu tree, scientifically and botanically known as *Acacia albida* and *Acacia tortilis* (also called *Acator*) is one of the most important tree in Malawi which has the potential to substitute artificial fertilizer in against economic challenges Malawian are facing. This paper therefore provides an analysis of a quick research on the importance of this fertilizer tree in addressing ecological problems particularly those to do with degradation of soil fertility and economic problems particularly that to do with heightened prices of fertilizer in Malawi.

WHY WE NEED TO BRING EINSTEINIAN PHYSICS INTO SCHOOL SCIENCE CURRICULA

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The purpose of this paper is to argue why we need to bring Einsteinian physics into school curricula internationally. The paper is a position paper, no empirical data are presented.

EDUCATION FOR SUSTAINABLE DEVELOPMENT: DOES MALAYSIAN SCIENCE CURRICULUM SUPPORT THE AGENDA?

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The increasing environmental crisis arouses global concern and numerous efforts have been directed towards saving the earth. One pathway is the integration of environmental education into the curriculum to emphasise the connectivity between the scientific, social, technological, cultural, and economic dimensions of people's life and the environment. . In Malaysia, environmental education (EE) is not mandated to be taught as a separate or a standalone school subject but to be treated as an infusion course of action across the curriculum. In this paper, we explore how the Malaysian science curricula across lower and upper secondary levels embed the big ideas in environmental education by analysing the syllabus and specifications using the Decade of Education for Sustainable Development (DESD) framework. We outlined the curriculum contents into four dimensions: environmental, social, cultural and economic; and discussed how each of these components was given emphasis in the curriculum. Drawing from the results of this study, we find that there is limited integration of the social and cultural aspects of environmental education and absence of direct economic link into the curricula.

Keywords: education for sustainable development; science curriculum

USE OF FORMATIVE COMPUTER-BASED ASSESSMENT IN FIELD WORK BIOLOGY

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This study examined the use of formative computer-based assessments (CBAs) with feedback into a field based modules in a 200 level Biology course. Non-exposure of interpersonal skills and self-management of the hidden curriculum amongst students has been identified. The sample consisted of 41 subjects for the years 2009 to 2011 and 38 subjects for the year 2004 to 2008. The CBAs were provided in 'tutorial' mode where each question had context related diagnostic feedback and tutorial pages, and a 'self-test' mode where the same CBA returned only a score. The summative assessment remained unchanged and consisted of an unseen CBA and written reports of field investigation. Aspects of the 'tutorial' and self-test CBA were found most useful as learning resource by students. After summative CBA, the formative CBAs provided exam practice (38%), liking diagnostic feedback (25%) and CBAs helped understanding (23%). After return of the reports, formative CBAs helped understanding of topics (46%), provided exam practice reports, formative CBAs helped understanding of topics (46%), provided exam practice (23%), helped subjects improve (23%). Formative CBAs in 2009 – 2011 was associated with a significant increase in summative CBA mean score but not for the mean score for written reports. The researcher recommends that CBAs be utilized in assessment as it enhances learning and interpersonal relationship.

Keywords: Computer-based assessment, formative, field-work, self-regulated learning.

PEER INSTRUCTION IN OUTREACH PROGRAM TO 4-6 GRADE ELEMENTARY SCHOOL STUDENTS

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Peer instruction is an active-learning pedagogy in which students answer short, conceptually based questions that are interspersed during instruction. This study reconstructs the class about “resonance” from activity-centered to inquiry-based and analyzes pre-test, post-test and individual paper test after one week. It seeks to understand the changes in student thinking that result from class with time. The curriculum is specialized for young students to apply the course of Light and Wave. Every class is made with 2 or 3 different experiment or activities. 59 elementary school students of grade 4 to 6 enrolled in the outreach program in Korea National Science Museum. The result of this study provides the inquiry-based resonance class with Peer Instruction is effective to 4th-6th elementary school students for understanding the resonance concept. For assessment the scientific concept, the conventional numerical format problems are appropriate to the 6th grade students.

PRIMARY/ECE/ELEMENTARY SCHOOL SCIENCE EDUCATION: INVOLV- ING THE PRIMARY LEARNERS IN ACTIVE SCIENCE LEARNING THROUGH DEVELOPING AND USING PICO LEARNING PACKAGES

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Primary education is well defined in the Nigerian National Policy on Education endorsed by the Federal Republic of Nigeria. Curriculum is developed to offer such education to learners to make them functional and responsible citizens. Goals are therefore outlined to guide the training of children in this direction in schools. First among the primary education goals is the inculcation of permanent numeracy, and ability to communicate effectively in the primary school learners. This paper discusses the use of game (play-way) method of teaching and learning in exposing learners to learner-centered or active learning. The paper introduces exciting and motivating learning packages that can help to enrich learners' capacities and develop in them learning capabilities. These learning packages are titled Power in Intelligent and Competent Operations, designed to promote inquiry-based/ activity-based/individualized or cooperative learning as well as scientific reasoning in the primary science learners. The use of these packages places the responsibility of learning on the primary learners. The paper recommends that primary science teachers involve learners in activities to promote "live science, love learning to create change positively in the learners. Teachers and learners should also engage in development, production and use of PICO learning packages for active learning.

IMPROVISATION OF TECHNOLOGICAL INSTRUCTIONAL MEDIA AND STUDENTS' PERFORMANCE IN PRIMARY SCIENCE IN NIGERIAN SCHOOLS

Idongesit Udosen

Significance of the Study

Any teacher who is concerned about his school children is bound to give thought to anything that would help them learn. The findings of this study are expected to benefit;

(a) all primary/elementary science teachers in all Nigerian primary schools in assessing the potentials of improvisation of local technological instructional media and materials towards enhancing students' curiosity for creativity, innovation and use of learning resource within the confines of the classroom and outside

(b) the learner as it will afford him the opportunity to manipulate basic process skills of observation and experimentation in the primary science course

(c) learners because improvisation of materials helps bridge gaps in course appraisals of contents, enrich existing curriculum and replace teacher-centred instruction

(d) everyone as most of science materials and equipment are very expensive in terms of importation, purchase and maintenance, therefore their substitution with locally produced, inexpensive but effective materials, so as to bring about a reduction in educational cost are of the essence. This would ensure that our classrooms are not lacking in instructional materials.

BASIC SCIENCES: A PATH FOR TEACHING CRITICAL THINKING SKILLS.

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The teaching of critical thinking from the learning of physics was the origin of this project, developed in different stages over three years. The need to generate students active motivated, independent, and able to generate creative processes, is a feature of the current education, where the contents pass into the background to give importance to the skills of thinking and reasoning. It is considered in the project that teaching critical thinking is fundamental to the development of modern education in Latin America, which has shown discouraging results in recent international tests. In this paper we present the proposed teaching critical thinking in the classrooms of the Escuela Tecnológica Instituto Técnico Central in Bogota, Colombia, which aims to identify whether it is possible to generate in the first semester students of Engineering, attitudes of critical thinker, from the design and implementation of an educational strategy focused on teaching critical think ing, and based on the parameters of such authors as Jacques Boisvert and David Perkins. We will show here a wide vision of the theoretical and methodological aspects, and some final project results, obtained during the process.

CREATING AN ENABLING ENVIRONMENT FOR GIRLS LEARNING ELECTRICAL TECHNOLOGY

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Factors influencing participation and achievement in Technology in school and beyond are of greater interest to Science and Technology education researchers in South Africa than ever before, given that the South African Department of Education has in the last few years combined traditionally female and male focused subjects into a new subject, Technology, which has been made compulsory for all pupils up to grade 9. This signals a desire to improve technological understanding and participation in technological careers in the population, for females as well as males. This intervention, addresses the needs of female students, but could quite easily be used to address barriers to learning due to educational background, socio – economic class or any other barrier that is related to student’s self-efficacy. Central to this intervention is the assumption that differences in participation and achievement of female students in Technology do not arise from differences in ability, but rather from wider societal attitudes towards certain fields of work. The lack of self-efficacy amongst women in terms of technological careers is in this article key to understanding the problem of underrepresentation of females in specific areas of the workforce. Aronsen (2005) defines self-efficacy as the “belief in one’s ability to carry out specific actions that produce desired outcomes”. Self-efficacy is developed through persistence and effort at a task and, as Bandura (1994) finds, people with high self-efficacy usually experience lower anxiety, and are more likely to view tasks not as difficult but as challenges that can be overcome. One way of developing self-efficacy is through mastery of difficult tasks, and in this intervention a gender-biased task is used to contextualise basic electrical concepts in an attempt to improve the self-efficacy of female students in electro technology. Improving participation levels in electro technology in tertiary institutions starts not in high school or in the years just prior to entering a polytechnic or university, but much earlier, in the home and in primary school when gendered beliefs of what is and what is not appropriate for women are formed. In this article, I provide a rationale through a brief literature survey for the design of the intervention. This is followed by a description of the intervention as well as a summary of the main findings of the study.

A MOTIVATIONAL APPROACH TO PROMOTING 21STCENTURY SCIENCE LEARNING

Jack Holbrook, ICASE Immediate Past President, Bulent Cavas, Chair of the ICASE Standing Committee on Publications, Declan Kennedy, ICASE European Regional Representative, Miia Rannikmae, Chair of the ICASE Standing Committee for ICASE- University Links

A concern particularly geared to students at an adolescent level, is the perceived irrelevance of the current science learning provision, noting its lack of student interest, abstractedness of the learning and hence its boring nature in the eyes of students (Osborne et al, 2003; EC, 2007). To address these concerns, this symposium introduces a three stage model which emphasizes the promotion of student intrinsic motivation (Deci and Ryan, 1985) as a prelude to initiating inquiry-based science education (EC, 2007) and consolidating the science conceptual learning through transference to socio-scientific situations requiring reasoning and argumentation skills to reach relevant decisions (Holbrook & Rannikmae, 2010). This symposium introduces an approach supporting teacher ownership of motivational science education, which when suitably supported by teachers' continuous professional development is shown to enhance the classroom learning environment through carefully constructed teaching/learning modules. While the frame for the learning is student-centred, within an inquiry-based science education (IBSE) setting, this symposium focus on the initial, intrinsic motivational approach and the manner in which this motivation is sustained during the change of emphasis to conceptual science learning in an IBSE setting and reinforced through a socio-scientific decision making stage. The approach is supported by a teaching module which introduces the student learning intended and guides the teacher by suggesting student activities, the teaching approach to adopt and possibly also give additional supporting ideas for the teacher, such as possible assessment strategies.

ADDING SOME SPICE: SUPPORTING SCIENCE TEACHERS IN WESTERN AUSTRALIA

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In 2006 science education in WA was still confronting a series of challenges that had been clearly highlighted in the 2001 report from Hackling, Goodrum and Rennie. Issues identified included problems associated with a traditional science curricula accompanied by a perceived lack of relevance; pedagogy that was teacher-centred rather than inquiry or student-centred; low student enrolments; poor incentives to attract and retain graduates into the teaching profession; and a lack of engaging resources that would enable teachers to implement a less traditional approach. The authors emphasised that ‘Teacher change is the basis of educational innovation, reform and improvement.’ SPICE is a partnership between the WA Department of Education and UWA that was established in response to the 2001 report. SPICE directly supports science teachers hence supporting the people that implement reform in the classroom but also capitalising on the multiplier effect of teachers carrying their message to students. The presentation will highlight the components that comprise SPICE and provide audience members with insight as to what elements comprise a successful outreach program. Results from a recent evaluation study will also be discussed. In addition, practical information regarding the SPICE curriculum resources will be included

CREATIVE IDEAS IN TEACHING/LEARNING SCIENCE

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Most young students enjoy playing with toys, manipulating materials and seeing magic. Appropriate activities can be found to stimulate intellectual curiosity, to develop problem solving and thinking skills, to promote discovery as well as to unleash creativity. This workshop will show how to make science lessons more meaningful, effective and interesting, how to cultivate intrinsic motivation for learning science, and how to develop thinking abilities, problem-solving skills and creativity. This workshop is highly interactive with lots of hands-on activities: Low-cost and effective pocket microscope and micro-projector using a laser beam ,science activities using a laser pointer, applications of Ultraviolet LED for environment study, low-cost water battery for sustainable energy activities, low-cost home-made radioactivity detector

Keyword: Science toys, Creativity, Curiosity, Out-of-school science activities

EFFECTIVE PEDAGOGIES FOR SCIENTIFIC DEVELOPMENT AND LEARNING IN THE EARLY YEARS

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In recent years there has been increased understanding of the pedagogies that support early scientific development and learning, that is, from birth to 8 years of age (e.g. BERA, 2003; National Research Council of the National Academies, 2007; Fleer, 2007). This workshop will focus on the pedagogies that have been found through research and practice to be effective in supporting early years scientific development and learning: Play, which theory and practice has shown to be synonymous with learning. Dialogic teaching in which children share ideas on an equal footing with peers and professionals. Exploration and problem-solving that motivate and support the development of scientific process skills. Creative approaches that can be used as pedagogical tools for knowledge construction and the development of positive attitudes.

A CLOSER LOOK AT SCIENCE EDUCATION IN ABU DHABI PRIMARY SCHOOLS THROUGH TEACHER SELF-EFFICACY

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Educational reform is at the heart of Abu Dhabi schools. Schools have made a commitment towards reforming education through exploring some of the world's best teaching practices some of which include making advances in the teaching of science. The research presented describes the science teaching beliefs of teachers in Abu Dhabi's primary schools. A standardized teacher self-efficacy instrument (STEBI A) specific to science education was used to collect data on teacher's perceptions of their strengths and weaknesses in the area of science education. On a general note, results showed a much lower sense of self-efficacy when compared to other studies elsewhere in the world, despite cultural similarities of the participating teachers who were largely Westerners. The results warrant further examination in order to better understand why such a gap exists and how this gap can be tackled.

USING VIDEO ANALYSIS, MICROCOMPUTER-BASED LABORATORIES (MBL) AND EDUCATIONAL SIMULATIONS AS PEDAGOGICAL TOOLS IN REVOLUTIONIZING INQUIRY SCIENCE TEACHING AND LEARNING

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La main á la pâte is an inquiry-based science education programme founded in 1996 by Georges Charpak, Pierre Lena, Yves Quere and the French Académie des Sciences with the support of the Ministry of Education. The operation of the program primarily aims to revitalize and expand science teaching and learning in primary education by implementing an inquiry process that combines spontaneous exploration through varied prediction, experimentation, observation and argumentation. As a recognized program of innovation in science, La main á la pâte has gained global visibility and transcended across cultural backgrounds. The strength of the program is founded on continuous educational collaboration and innovative projects among pioneering institutions and educators for more than a decade. The emphasis of “learning by doing” as a principle of inquiry in science is a pedagogical movement since the late 18th century traced to the works of John Locke, Jean-Jacques Rousseau and John Dewey. In their progressive education program, truth and knowledge are out of observation, direct manipulation and concrete experience of objects (Hayes, 2007). The methodology is focused on the child’s interests and intrinsic motivation to learn. According to Dewey, a child that is thrown into a passive role of absorbing information results to a waste of that child’s education. The role of the teacher therefore is to guide students’ as individuals and allow learning to unfold naturally (Butts and Cremin, 1953). This educational philosophy set the tone for the “new educational thinking” which provided reforms in many educational institutions around the world. Furthermore, the rise of favoured industries and the age of information and communications technology have somehow influenced the kind of education that institutions offer. In recent years, educational technology has been used to support teaching and learning in many developed countries. Technology has dramatically transformed the way students acquire information, exchange data and communicate in the classroom using automated hand-held devices such as tablet PCs in different platforms, probewares, data loggers and other pedagogical tools. Other than varied experiments in modern science laboratories, they are exposed to educational softwares, simulations and other interactive models. These developments led many educators to reconsider teaching strategies in general and evaluate ways in which technology has influenced classroom practice and experience in particular. While these new perspectives support educational philosophies and form the basis for the emerging standards in science education, enhancing learning through inquiry using these technologies post a greater challenge.

There is no doubt that these tools enrich the students’ experience in understanding science and developing their scientific skills. However, the need to define its role in providing effective links among extended information, ideas and real-life experiences become crucial.

This paper generally focuses on revolutionizing inquiry-based science education (IBSE) approach using technology-based pedagogical tools at pre-university levels. Since there is no universal model for the IBSE, it is understood that the operation of this program is dependent on the course of study, the teacher, the students’ stage of development and the resources available. Nevertheless, the indicative measures and evidences of inquiry teaching and learning in this context will be discussed. Specifically, the first section of this paper discusses the IBSE in detail and presents areas in which technology can be used to potentially enhance teaching and active learning in the “new classroom”. The features of well-recognized educational software with the same underlying positions on IBSE will also be given. The second section presents activities that combine technology and inquiry and the inherent issues on assessment. It includes examples of thinking models that students are engaged in during the inquiry operation.

Finally, actions of various kinds have been taken in the hope of bridging the gap between a variety of technology-based resources and the IBSE. Challenges at any point are inevitable but this should not impede continued experience as a process of building the understanding of science through inquiry. Whether or not supported by these resources, the ultimate goal is to develop life-long learners who understand.

REFLECTIVE LEARNING FOR HIGHER ORDER THINKING

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Inquiry is a central theme in the Singapore Primary Science Curriculum which encourages students to be “Inquirers” and teachers as their “leaders of Inquiry”. Inquiry requires deep thinking skills and a reflective learning habit. The habit of inquiry is also linked to a greater propensity to think at a higher level. This could be a result of the greater proportion of time spent on reflecting on the different phases of learning. This study involved 30 primary five students from a typical government- sponsored school. A process skills test aligned to the higher order skills of Bloom’s level of Taxonomy was used. It was found that there is a clear correlation between the variables for the process skills tested and the information coded for inclination-to-reflect. Also, it was observed that the groups working on the inquiry-based learning tasks exhibited more frequent reflective responses in their journals and interviews than students working on the procedural tasks. Results from the students’ performance on the tasks also indicated that being more reflective helped in boosting their abilities to solve problems requiring higher order thinking skills. The use of inquiry-based learning activities could have made students become more inclined to reflect and this learning habit would have enabled students to perform better at higher order thinking tasks.

FACTORS AFFECTING THE CHOICE OF SCIENCE SUBJECTS AMONG GIRLS AT SECONDARY LEVEL IN MAURITIUS

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This research attempts to identify the factors which influence the choice of science subjects in Mauritius among girls at the end of the third year of secondary education, the level up to which science is a compulsory subject. This low uptake of science subjects by girls beyond the compulsory level is a matter of concern. The study was undertaken in four purposefully selected schools in Mauritius, two mixed-sex and two girls' schools. Using mainly a qualitative approach, data were collected through: (i) non-participant observations of 60 science and 20 non-science lessons, (ii) 16 semi-structured face-to-face interviews of teachers, and six group interviews with pupils and (iii) 135 questionnaires administered to the parents of the pupils in the classes observed in the four schools. Based on the results of a pilot study, modifications were made for the main study. The data provided insights into teachers' teaching approaches, the behaviour and interest of pupils in the lessons and other factors such as pupils' perceptions of science, their self-identity and role models, and the extent to which parents and peers influence the choice of subjects among girls. The findings show that teaching approaches were mainly traditional and that both girls and boys prefer hands-on activities and contextual examples reflecting real-life situations. The majority of the girls' experiences of science were negative and this deterred them from taking science beyond the compulsory level although they were aware of its importance. Teachers had positive opinions about girls' ability to do science but stated that lack of infrastructure facilities did not allow them to involve the pupils in practical work as much as they would wish. However, brighter girls' decisions to study sciences were not outweighed by these factors. Parents felt that they did not influence their daughters in the choice of subjects or eventual careers though they held science in high esteem.

STOPPING BEFORE THE FINISH LINE: TEACHER TRANSFORMATION THAT RESULTS IN IMPROVED STUDENT ACHIEVEMENT TAKES TIME

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In our quick-paced, hurry-on-to-the-next-great-thing educational systems, we run a risk of tossing out great initiatives before we know how well they worked. The work of Supovitz and others have often been cited as the benchmark for what is necessary for successful sustained professional development. However, even though change occurs during the 80+ hours of intervention, teacher transformation that results in increased student achievement may not be reached until after this time. Our professional development goal for this study was to improve the quality of inquiry-based instruction led in the classroom. Research from four years of work shows that even though teachers begin to transform their practice during year one of a sustained intervention (80+ hours) student achievement gains do not consistently follow until the second year. The importance of this study shows how critical it is to follow teachers and their students for a second year to see if transformation takes root and becomes a stable part of the teaching and learning environment thus resulting in increased student achievement.

STRENGTHENING PRE-SERVICE TEACHER ENGAGEMENT WITH PRIMARY SCIENCE: COLLABORATING WITH SCHOOLS

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Primary school science has an important role in laying the foundations for creating successful life-long science learners. However, international research indicates that many primary teachers lack science knowledge and the confidence to teach science. The existing situation raises questions about the effectiveness of traditional approaches to primary teacher education with regard to science teaching and learning. The current research of a multi-university team investigating innovative teacher education approaches will be shared as a starting point for a broader discussion about preparing pre-service teachers to engage with primary science. In particular, the research relates to school-based teacher education programs as a way of providing authentic experiences for pre-service teachers engage with primary science. In particular, the research relates to school-based teacher education programs as a way of providing authentic experiences for pre-service teachers that connect them and their students to science learning in primary school contexts. Building strong relationships between teacher educators and their partner schools is integral to school-based programs. The facilitators of this session are interested in exploring with participants their collective experiences related to science teacher education and ways that schools and universities might work collaboratively to enhance science learning in primary schools. The session is intended for anyone interested in primary science teaching and learning including currently practising teachers, students, academics and teacher educators.

**“WHY DIDN’T THEY TELL ME”?
EDUCATION in the WORKPLACE**

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Industry is always on the lookout to improve workplace practice in an effort to prevent accidents and to improve obvious financial implications associated with workplace injury. As well, there is a strong professional ethic associated with creating a safe work environment for employees. Behind this recognition, relatively little independent safety programme research has been conducted particularly from inside and within an organisation. Rather, within evaluation frameworks, relatively little effort is made to critique the slippage that exists between rhetoric and practice. This paper reports on an industry case study undertaken to interrogate the understandings and experiences of workers and managers in relation to workplace health and safety. Drawing on a range of data collection methods, including observations, interviews and questionnaires, the research explores workplace health and safety as related to education and training experiences. The data reveals the existence of a tension between what is perceived as a culture of compliance, rather than a culture of education and development. Whether intended or not, the full emphasis on compliance, at both management and employee levels, then can undermine the effectiveness within health and safety programs.

PROBING MATTER: ENGAGING SECONDARY STUDENTS IN AUTHENTIC RESEARCH WITH A SYNCHROTRON

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The science classroom is the hub for learning this discipline. Students develop the scientific inquiry process through the use of experiments which offer a hands-on, minds-on approach. Most of the experiments they perform are predictable, imposed, and already designed. Working with scientists has been, for a few decades, encouraged but not necessarily applied wholesale in the education community. The Canadian Light Source's synchrotron is at the disposal of student-teacher teams along with their own scientists to encourage authentic research. Secondary students apply a research protocol of their own design with the help of their teacher and synchrotron scientists. The research process of two experiments designed by students will be presented: Study of the Meteoritic Melt Sheet of the Manicouagan Basin and Effects of Olivine on the capture of NO_x. Results have shown that teachers bring in the classroom a more authentic and new experience in research application. As for the students, their unique research has contributed to the increase of our knowledge and a better understanding of the scientific inquiry process.

SCIENCE ON STAGE: A TEACHER ORIENTED APPROACH TO SCIENCE LEARNING AND NETWORKING IN AN INTERNATIONAL COMMUNITY

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Science on Stage is a European initiative designed to encourage teachers from across Europe and Canada to share best practices in science teaching. Focused on teachers, the main objectives of this organization are to bring them together by offering them a platform to exchange teaching ideas for the sciences, to inspire and re-enthuse them, to inform them about wider science research, and to raise the profile of science teaching with education ministers in the countries involved. The ultimate goal of Science on Stage is to improve science teaching and thus encourage more schoolchildren to consider a career in science or engineering.

DRUGS, BANANAS AND EARRINGS

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Context-based chemistry (see, e.g. King (2012) for a recent review) ‘aims to improve student interest and motivation in chemistry by connecting canonical chemistry concepts with real-world context’. The Case Study used in this work takes some basic chemical themes pertinent to the real lives of the audience and elaborates the relevant chemistry in the contexts of jewellery, soap and detergents, liquid beverages, the human digestive process, and historical episodes based on medical knowledge.

Using ICT to support Science Inquiry Learning

John Williams

This research project aimed to understand and explore the ways electronically networked (e-networked) tools can support authentic science inquiry in junior secondary classrooms in order to address concerns raised over student engagement in science. Internationally claims are made about the potential for inquiry based learning to address the challenges of relevance for the 21st century school science learner (Aikenhead, 2005; Bolstad & Hipkins, 2008). Deliberate inclusion of activities such as collaboration, co-construction and confirmation of ideas is appropriate and valued in science inquiry but they tend to contrast with many of the practices found in conventional classrooms. These activities require more student freedom and the capacity to pose and meaningfully pursue questions of their own design. They may also require students to go beyond the confines of the physical classroom, and venture into virtual communication environments. The findings highlight that e-networked tools can support collaboration and the co-construction of knowledge within and across an inquiry cycle.

THE NEED FOR DEVELOPING A NEW CURRICULUM ON CLIMATE CHANGE FOR TEACHER EDUCATION IN NIGERIA

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For some years, scientists recording global temperatures have noticed an almost imperceptible but steady rise in the average global temperature. There is evidence that average global sea level is rising. There are dramatic changes in weather all over the world. The unending heavy rains followed by devastating floods; the unusual heat waves; the melting polar ice and glaciers etc. Climate change is a major challenge of the twenty-first century for the entire world. We are all subject to these vagaries of the world's environmental processes and bound to seek ways of adapting to or mitigating them. Indeed, most of the disasters and death since the 1950's globally are climate-related. Developing curriculum on climate change is a way of making it and its devastating effects educational issues, thereby involving the youth in the tinkering process early in life. This paper discussed the need for the infusion of climate change content materials into the teacher education curriculum. The teacher is the most critical element in the learning process that need to be trained and educated on climate change matters to be able to impart the knowledge to his or her students. The paper highlighted the concept, causes and effects of climate change and suggested content materials to achieve the aims and objectives of climate change curriculum at teacher education level.

ITEM TYPES AND UPPER BASIC EDUCATION STUDENTS' PERFORMANCE IN MATHEMATICS IN THE SOUTHERN SENATORIAL DISTRICT OF CROSS RIVER STATE, NIGERIA

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This study was designed to establish the influence of item type on Upper Basic Education students' academic performance in mathematics. Using an ex-post facto design with a population comprising all Upper Basic Education students in both public and private secondary schools within the Southern Senatorial District of Cross River State, Nigeria, a sample of 886 Upper Basic Education (UBE 3) students in the Senatorial District supplied the needed data. This sample was drawn using the stratified random sampling technique. The same Mathematics achievement test constructed by the researchers was in three different forms, namely: the multiple choice test, the essay test and the completion test. The data were collated and analyzed using the Analysis of Variance repeated measures. The study revealed that there is a significant influence of item type on UBE students' performance in mathematics. Students performed significantly better in mathematics test presented in multiple choice form than in the completion and the essay form. The study concluded that students' performance in mathematics at the Upper Basic classes could be influenced by the item type administered during testing. Based on this empirical finding, recommendations were made to the authorities concerned.

IMST - THE AUSTRIAN WAY TO MODERNISE THE EDUCATIONAL SYSTEM

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The IMST-project (Innovation in Mathematics and Science Teaching)was established in 1997 in the wake of the disappointing results of the TIMMS'95 study. The project is still running and scheduled even till 2020. The IMST-project has produced a number of spin-offs“ that have changed the otherwise very inert Austrian educational system considerably. Teaching methodology for sciences was established at a number of Austrian universities. Regional Networks and Regional Competence Centres were set up in all Federal States of Austria. The Regional Networks developed their own individual ways to professionalise teachers and support science teaching. They also found individual ways of third-party-funding. The Regional Competence Centres contribute to teacher education and development of in-service-teachers. They also provide databases for good practise in science teaching. The traditionally fragmented Austrian educational system is on its way to unification. The notorious problem of two parallel types of schools with two differently educated groups of teaching staff at junior secondary level should finally be overcome in the course of the next 10 years.The contributions from IMST to this huge improvement were remarkable.

RELEVANT, USEFUL AND MEANINGFUL SCIENCE FOR PRIMARY/ECE/ ELEMENTARY SCHOOLS ON A MINIMAL BUDGET

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It has been reported that much of the science taught in schools is not especially useful in everyday life. This has been the case for example in New Zealand (Bull, Gilbert, Barwick, Hipkins, & Baker, 2010), Australia (Tytler, 2008), England (Osborne, Driver, & Simon, 1986) and Sweden (Lindahl, 2003). Three reasons are commonly reported for this ineffective approach to science in schools: teachers' self-reported lack of content knowledge in science, a perceived lack of resources for teaching science, and sufficient time for effective teaching of science due to the crowded curriculum (Education Review Office, 2012; Fisher, 2010; Fraser, Aldridge, & Adolphe, 2010; Novak, 2002). While there is a considerable amount of literature around the research into supporting the continued professional development of teachers' content knowledge (see for example Appleton & Kindt, 1999; Duschl, Schweingruber, & Shouse, 2007; Harlen & Holroyd, 1997), this workshop is designed to demonstrate through practical hands-on activities how teachers are able to overcome the perception of lack of resources and time. It is the explicit intent of this workshop to demonstrate how to present relevant, useful and meaningful science at the primary/ECE/elementary school level (Sexton, 2011).

BUILDING NATURE OF SCIENCE: PROFESSIONAL DEVELOPMENT MODEL TO ENHANCE TEACHING PRACTICE

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The Nature of Science (NOS) has been introduced in the New Zealand Curriculum for English-medium teaching and learning in years 1 - 13 (NZC) (Ministry of Education, 2007) as the overarching strand through which the contexts of science are developed. This new focus for science teaching in New Zealand schools raised the issue of how well developed teachers' understanding of NOS might be and how to best build NOS understanding of teachers through a professional development if needed. . Initially the NOS understanding of a representative sample of teachers was explored using the Nature of Science as Argument Questionnaire (NSAAQ) developed and trialled by Sampson & Clark (2006). The results indicated the need for teacher upskilling in NOS understanding. Design-based methodology was used to design a professional development programme focussed on building theoretical understanding of the Nature of Science (NOS) through use of a range of teaching and learning approaches to NOS. A range of qualitative and quantitative data was collected to ascertain if this design facilitated changes in science teaching practice. The analysis indicated that exposure to a theoretical understanding of the NOS through a professional development programme facilitated changes in science teaching practice for 72% of participants Kate Rice.

INDUSTRY-EDUCATION SCIENCE PARTNERSHIPS: AN INTEGRATED APPROACH

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With the increasing skills shortage, number science graduates declining and the negative perception to the agricultural / primary industry, the development of sustainable partnerships between students/teachers and industry/research organisations is critical in securing future scientists for employment in Australia's Primary Industry sectors. The Primary Industry Centre for Science Education (PICSE) is a national Australian program which is an integrated model of collaboration between the governments, research and development corporations, universities, schools, national and regional industries and community organisations. The primary goal of the PICSE program is to support young people's interest in science, and their subsequent participation in tertiary study leading to research or careers relating. This workshop will provide: an overview the individual aspects utilised: science class activities, teacher professional developments, student camps, industry placements and teaching resources; data on overall program impact; and the opportunity for discussion of issues/concerns when establishing effective partnerships.

LEVELING THE PLAYING FIELD: PROVIDING GLOBAL ACCESS TO HIGH QUALITY STEM LEARNING VIA MOBILE ACCESS TO REMOTE LABORATORIES

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A study by the National Research Council (NRC, 2006) found that, in the United States, “most high school students participate in a limited range of laboratory activities that do not help them to fully understand science process” and that “the quality of current laboratory experiences is poor for most students” (p. 6). The report also indicated that the cost of lab supplies and the infrastructure needed to maintain such labs are often insurmountable obstacles for many schools. Even in schools that can provide appropriate experimental infrastructure, lab opportunities require significant teacher planning, preparation, set up, and cleanup time. The situation is of greater concern in developing countries where resources are scarcer. Our goal is to investigate the promise of remote online laboratories in making learning STEM practices and concepts through real science investigations more personalized, authentic, engaging, and broadly accessible for all students. Ultimately, if proven successful, remote online labs could supplement locally provisioned school labs with a centrally-provided (i.e., “cloud based”) service in which schools could more cost-effectively lease access to remote lab equipment rather than having to purchase, maintain, and resupply it.

FOCUSING ON SCIENCE IN THEMATIC TEACHING – THE CHALLENGES AND OPPORTUNITIES

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Thematic or cross-curricular planning is increasingly valued in practice internationally, raising questions about how the distinctive contribution of science is maintained while valuing the potential of a more ‘creative curriculum’. The UK-based ‘See the Science’ Project funded by the AstraZeneca Science Teaching Trust aims to secure and strengthen the place of science within a thematic, ‘creative curriculum’ in primary schools (4-11 years) by analysing how science appears within planning and practice when teachers are mindful of improving the quality of classroom talk by increasing the opportunity for sustained dialogues. By understanding dialogic talk as promoting multivocal discourse we argue it can play a role in developing creative pedagogies. Case studies explore how teachers are using a variety of forms of curriculum planning and the implications of this for science. Audio recordings of classroom talk have been transcribed and analysed to prompt reflective dialogues and document developments in practice. A new primary national curriculum for England to be implemented in 2014 poses opportunities, challenges and threats to classroom practices that value sustained dialogue and thematic or ‘creative curriculum’ planning.

A PRACTICE OF DEVELOPING NON-FORMAL EDUCATION PROJECT ON CHEMISTRY EDUCATION IN SCIENCE CENTER

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Chemistry exhibition is rarely seen in science centers, mainly because, 1) chemistry relates to many other sciences, 2) chemical reaction is irreversible, 3) the changes are difficult to present at microscopic level, and 4) safety concerns. Usually chemistry appears in science shows or just integrated with other exhibits as pieces of knowledge. Dow Chemistry Lab, developed by CAST and Dow Chemistry Company, is a non-formal education project on chemistry settled in science centers. The project provides interactive and informative exhibits and hands-on activities for 5-9 grade children to help them understand what chemistry is and how chemistry helps to make our life more sustainable. Using ADDIE model the project aims to enrich participants' experience and create a comprehensive image of chemistry in limited space through integrating different approaches in the selection of concepts, and the design of exhibits, context and activities, which will consequently enhance the public recognition of the project. The practice indicated that, through re-designing displaying items and educational activities which serve as a good supplement to the exhibits, transforming stereotyped exhibits under a new conceptual framework, and using exhibition to have people motivated, chemistry can be presented in a more acceptable way in science centers which will provide meaningful and effective learning experience to the audience.

INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) IN SCIENCE EDUCATION: LESSONS LEARNT AND THE WAY FORWARD

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It is increasingly realized in the advent of digital era that the wise and critical use of scientific Information and Communication Technology (ICT) are essential especially in enhancing the quality and reach of science education. This paper reviews several research studies on the ICT integration in science education with evidence of students' science achievement (such as the recent analysis on TIMSS 2007), higher order thinking (HOT) and motivation. The findings revealed that computer use was positively associated with high student achievement. The students who indicated that they use computers both at home and in the school were those with highest science achievement. There is also evidence of students' enhanced HOT and motivation towards lifelong science learning from studies on problem-based science learning integrating ICT. The author also develops a conceptual framework for the way forward towards the implementation of „borderless school“, RECSAM's mandate to one of the eighteen areas identified under the vision of Golden SEAMEO in the next decade. A „borderless school“ is operationally defined as a school that prepares students to become global players who are enterprising, creative, innovative, equipped with 21st century skills and lifelong learners. Lessons learnt from previous studies will be elaborated with educational implications deliberated. Topic or innovative, equipped with 21st century skills and lifelong learners. Lessons learnt from previous studies will be elaborated with educational implications deliberated. Topic or stream identified: STE and future direction.

WHY DO CITIZENS DONATE TO SCIENCE? MOTIVATIONS OF THE SKYNET VOLUNTEERS.

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TheSkyNet is a combined distributed computer and science communication project based at ICRAR in Perth, Western Australia that launched in September 2009. Anyone with an Internet connection and a computer can connect to theSkyNet and donate the spare processing power of their machine to help process data for astronomy researchers. All the computers in theSkyNet are connected into one supercomputer, something that is much more capable than the individual parts alone. There are hundreds, if not thousands, of distributed computing projects available for interested parties to choose from, so why have the thousands of members of theSkyNet chosen us? What about our project distinguishes it from the 100 other active projects available through popular distributed computing platform 'BOINC'? TheSkyNet began on a new distributed computing platform, and has since expanded into the well-established BOINC platform six short months ago. Since then theSkyNet has become a BOINC top 20 project, attracting almost 1500 new users and over 4000 computers. We will discuss the reasons behind the success of theSkyNet and how we have turned passive citizen science into active science communication through reward systems and other incentives.

CONTEXTUALIZED USE OF TECHNOLOGY IN SCIENCE CLASSROOMS BY HIGH SCHOOL SCIENCE TEACHERS.

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The benefits and the potential of technology in education in general, and science classrooms in particular, have been well enumerated by researchers. Unfortunately, most technologies are not educational by their very nature. Therefore teachers continue to explore those ways of integrating technology for effective teaching and identifying factors that affect how and which technology to use for effective teaching. One important factor is the context within which teaching and learning is occurring. This multiple-case study reports how science teachers use technology in different contexts. The study observed six science teachers from two schools to find out how they use technology in their teaching. The teachers were observed in two teaching contexts: a senior high school class and a junior high school class. Findings indicate that the content subject matter did not affect teachers' use of technology appreciably. However, teachers used technology differently when they taught different levels of students (i.e. the junior high and senior high contexts). All of the teachers used technology to foster inquiry learning in their junior classes whilst in senior high classes, they used technology as an add on to help explain and elaborate an already taught concept.

WATER QUALITY AND CHARACTERISTICS OF BACTERIA FROM UNIMAS FISH FACILITY

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Maintaining the quality and safety of the water is important as the contamination of the water can cause serious illness or even death among the creatures in the water. In this study, chemical and microbiological water quality was determined. Samples of water were collected from fish facility of Department of Molecular Biology, Faculty of Resource Science and Technology, UNIMAS. These water samples were analyzed for the presence of bacteria. Bacteria were isolated from the water and were characterized. The DNA extraction of the bacterial isolates was performed by boiling-centrifugation method. The genetic variations among the isolates were analyzed by (GTG)5PCR. (GTG)5PCR analysis indicated that the isolates were grouped into 2 main clusters. Then, the isolates were picked from the dendrogram for PCR to amplify the 16S rRNA gene of the isolates. Twelve isolates were chosen for sequencing for analysis. Among the twelve isolates, eight isolates were *Aeromonas veronii*, two isolates were *Aeromonas jandaei* and the last two isolates were *Plesiomonas shigelloides* and *Pseudomonas alcaligenes*, respectively. All isolates from the water were tested for their antibiotic resistance by disc diffusion method. All of the isolates were tested to be resistant towards ampicillin, penicillin and gentamicin. The MAR index of the isolates ranged from 0.455 to 0.727. The multiple antibiotic resistances of the isolate indicate the high potential hazard associated with antibiotic-resistant bacteria in water.

Key Word: Water quality, bacteria, (GTG)5PCR, 16S rRNA, disc diffusion method.

SEEING THE UNSEEN: USING TECHNOLOGY TO HELP STUDENTS SEE AND UNDERSTAND DIFFICULT SCIENCE PHENOMENA

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In the traditional science laboratories, many experiments were difficult to measure and complete in a short class period. Some phenomena such as sound waves or fast temperature or pressure changes were almost impossible to see using traditional equipment. Fortunately, with the advent of new technologies, such difficulties are a thing of the past. Students can now use affordable probeware to measure parameters previously not possible and complete such investigations with ease and explore “What if” situations all within one class period. During the workshop, participants will have an opportunity to try our user-friendly systems first hand.

INCORPORATION OF STEM (SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS) TEACHING AND LEARNING STRATEGIES INTO BIOLOGY CLASSROOM

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The STEM teaching and learning strategies proposed in this paper is 5E approach (Engage, Explore, Explain, Extend and Evaluate) learning cycle, Understand by Design, Integration of Digital technologies in teaching and learning, inquiry-based teaching and learning, problem-based teaching and learning, performance-based teaching and learning, formative and summative with both task and non-task rubric. These strategies are incorporated across BTEM (Biology, Technology, Engineering, and Mathematics) Module which is developed by the researcher to allow students to act like a dietician, nutritionist or food engineer to solve complex human's problems in real life. By then, the ultimate goal of BTEM Module is to help students to master both 21st century skills and the factual knowledge of biology simultaneously. Specifically, this paper will discuss the integration strategy in BTEM and how it could be implemented within the context of science teaching and learning.

THE USE OF LOOP AMP IN DETECTION OF SHIGA-TOXIN (STX) GENE AMONG ESCHERICHIA COLI FROM AQUACULTURE AND OTHER ENVIRONMENT

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Considerable amount of cases of Shiga-toxin producing *Escherichia coli* (STEC) has been reported which result in the need to detect the presence of this harmful *E. coli* in food and environment sources. Diseases caused by STEC are Hemolytic Uremic Syndrome (HUS) and Hemorrhagic Colitis (HC). A lot of samples being used in researches are mostly from retail chain store or farms. The need to look into aquaculture and other environmental water is very crucial since there are very few researches done on aquaculture and other environmental water. In this study, samples were taken from Asajaya Empurau fish farm, Damai river stream, Permai beach and Permai rainforest resort. Enterobacteriaceae were successfully isolated using Eosin Methylene Blue agar and *E. coli* were successfully identified through a series of biochemical test. DNA was isolated using boiling method and Loop-AMP was conducted to detect toxigenic genes carried by *E. coli*. It was found that none of the isolates were carried stx 1 or stx 2 gene. However, multiplex-PCR detected three isolates which carried stx 1 and stx 2 gene. (GTG)₅-PCR was carried out to detect the diversity among the isolates and was found that genetic diversity among *E. coli* isolates were not high. Two major clusters with one of the cluster having 2 sub clusters were detected. Water quality for Damai downstream, Damai middle stream, Permai beach, Permai rainforest resort were classed IIB which is safe for water recreational activities with body contact.

Keywords: *Escherichia coli*, Biochemical test, Loop-AMP, stx gene.

INDOOR AIR QUALITY TESTING FOR BACTERIA INSIDE THE SWIFTLET HOUSES

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Air consists of such tiny organisms as bacteria, fungi, mycotoxins and viruses. Exposure to these airborne bacteria indoors may cause infectious and noninfectious adverse health effects. However, the sources and origins of bacteria are not fully understood. The aim of this study was to test the air quality for bacteria present in the air inside the swiftlet houses located at Kota Samarahan, Samarang, Maludam and Sepinang in Sarawak. A total of 40 bacteria isolates from 12 samples were collected from swiftlet houses. The bacteria present in the air were collected using Plate Count Agar. Two plates were exposed at the front and the back inside the swiftlet house for 30 seconds, incubated at 37°C for 24 hours. Genotypic identification were carried out to identify the isolates from the samples. The air inside the swiftlet house had a total colony count between 2 cfu to 50 cfu. Bacteria isolates from the indoor air in swiftlet house were *Corynebacterium* spp. (27.5%), *Staphylococcus* spp. (25%), *Bacillus* spp. (22.5%), *Enterococcus* spp. (7.5%), Unknown (5%), *Yersinia* spp. (2.5%), *Proteus* spp. (2.5%), *Klebsiella* spp. (2.5%), *Aeromonas* spp. (2.5%) and *Streptococcus* spp. (2.5%). Inhalation exposure to these microbes may pose health risk to human, thus future study should be carried out to determine the pathogenicity of these microbes.

Keywords: Swiftlet house, Air quality, Bacteria, Biochemical tests.

EXHIBITS FOR PUBLIC EDUCATION ON EINSTEINIAN PHYSICS AND GRAVITATIONAL WAVES

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Gravitational waves are the deepest manifestation of Einsteinian physics. They are produced by the most extreme states of matter - black holes - that can only be understood in the context of Einsteinian physics. Gravitational wave receivers now being developed involve the most exquisite instrumentation working in a regime where the quantum properties of massive objects determine their behaviour. This talk will focus on large scale exhibition material developed by physicists at the Australian International Gravitational Research Centre for the purpose of explaining gravitational wave physics to school students and the general public. The talk will include extensive video illustrations.

DEVELOPMENT OF A MIXED DIPTEROCARP FOREST SPECTRAL DATA-BASE OF LAMBIR HILLS NATIONAL PARK.

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In Malaysia, the dipterocarps species has been subject to exploitations under different policy regimes leading to degradation and deforestation. The decline in forest areas and resources resulted in the need to utilise these resources sustainably. Crucial information on the species distribution are seriously lacking for sustainable management and conservation efforts as some of the family member that are already listed in the International Union for Conservation of Nature (IUCN) Red List either as critically endangered, vulnerable or extinct. In this study, we are using the airborne imaging spectrometer to map the distribution of individual tree stands with large canopy crown which will be used for describing forest composition providing information on species dominance and important value analysis of species diversity of the mixed dipterocarps forest at Lambir Hill National Park. This project aims to provide spectral data for trees identification and species diversity and to make recommendations in the form of strategies and actions plans to improve the current conservation of threatened species through assessment and knowledge sharing within scientific communities and resource managers.

Keywords: Lambir Hills National Park, Mixed dipterocarps forest, Species diversity and identification, Spectral mapping.

AUTHENTIC LEARNING CONTEXTS FOR ACTION-BASED PROBLEM SOLVING

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In this workshop, participants will consider a range of learning contexts for developing action-based problem-solving, that involve some practical work and the use of the internet for inquiry. Participants will share what they currently do to integrate science content, inquiry models using the internet and practical work and thinking skills for developing actions for social and environmental problem-solving. Improving water quality will be used as an example of how a range of resources and activities can stimulate children's thinking. Participants will develop strategies to help children to ask questions to drive action-based problem-solving.

CHARACTERISATION AND EXPRESSION STUDIES OF GROWTH FACTOR RECEPTOR BOUND PROTEIN 14 (GRB14) GENE IN VERTEBRATE DEVELOPMENT

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The accomplishment of the human genome project (HGP) brings with it the errand of identifying and interpreting the sequence, carrying it from sequence to function. The zebrafish has rapidly emerged as the forerunner animal model for scientists riding to the next wave of genome exploration, being uniquely positioned to study vertebrate development. In this study, zebrafish was used as the animal model to isolate and characterise a gene, Grb14 genes involved in embryogenesis developmental process. Grb14 is the latest identified members of Grb7 superfamily of adaptor protein, which participates in the functionality of multiple signal transduction pathways under the control of a variety of activated tyrosine kinase receptors (RTK). To date, the functional roles of Grb14 adaptors is not fully understood. At the present time, a role for this Grb14-RTK interaction was only established in the regulatory effect on RTK signaling especially in insulin receptor signaling inhibition as well as cell migration and tumor progression. In respect that most of the current knowledge and understanding of Grb14 adaptor protein come from mouse studies, therefore, this study aims to investigate the expression pattern of Grb14 throughout the development of zebrafish, whose cell migration process during embryonic development is well-understood. It is hoped that the information gained from this animal model system will facilitated in the understanding of human and vertebrate organogenesis and development. Firstly, semi-quantitative RT-PCR was employed to examine the temporal expression pattern of Grb14 in ten stages of zebrafish development and ten adult organs from adult zebrafish respectively. Our results denoted that Grb14 gene was expressed.

APPLICABLE OF MANIPULATIVE MATHEMATICS EDUCATION GAMES TO DIGITAL AGE CHILDREN

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As we know, nowadays' children have been exposed to computer digital games at their very early age. We cannot deny that the digital technologies do help children in their teaching and learning processes. Both Piaget's Child Development Theory and Vygotsky's Social Development Theory support that the child learn best when they playing with the concrete stuffs with their friends. In this paper, the researcher proposed to apply the manipulative mathematics education games. The manipulative games in this study refer to card games and linear board games which are designed for preschool students. These games are believed able to enhance children soft skills in term of communicate their thought with peers and teachers, intellectual and social behavior.

A COMPARISON OF PUBLIC VERSUS PRIVATE SCIENCE EDUCATION IN PRIMARY SCHOOLS: THE CASE OF ABU DHABI

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A common perception among parents is that a private education is superior to a public education. Given the shortage of STEM professionals internationally, it behoves us to examine how these educational systems compare in preparing students for careers in science. This study compares public and private science education in Abu Dhabi primary schools. A survey was used to assess teachers' perceived strengths and challenges in teaching science. Perceptions of primary school principals were also analysed through individual interviews. Both sets of data sources were coded and several themes were identified. This study cannot conclude that either public or private education is superior in this context. However, it does delineate how they differ. Many of the identified issues could be addressed by targeted, well publicized professional development which focuses on both teaching science content and integrating science throughout the curriculum.

SEEING WITH 'EYES' ANCIENT AND MODERN: A VISIT TO SOME GREAT DESTINATION ALONG THE ELECTROMAGNETIC SPECTRUM

Lynn Beazley

The electromagnetic spectrum is in principle infinite. The limit for long wavelengths is the size of the universe itself, for short wavelengths it lies in the subatomic range. In this talk I will address those wavelengths that are arguably of particular relevance to us, namely those that penetrate the earth's atmosphere to reach us. These are broadly what we term visible light and radio waves. The human eye sees a narrow band of wavelengths as colours from red to violet. I will describe how our visual systems achieve this, as well as how colour vision probably arose in Devonian fishes and has evolved since then. I will describe the colours animals see, from narrower than ours (a red rag is presumed to be greyish green to a bull) to greater than ours, extending into far red and/or ultraviolet. This information helps us understand animal behaviour and informs our efforts to protect endangered species. I will also provide an insight into and an update on Australia's \$50 million program to develop bionic vision, aiming to restore sight to the blind and emulate the success of the Bionic Ear. Moving along the spectrum to the long wavelengths, is the world of radio-astronomy. Many young scientists-to-be are already excited by arguably the largest science project ever planned for our planet: the Square Kilometre Array (SKA). This multi-nationally supported mega-network of radio telescopes is being built across deserts in South Africa and Western Australia. It will require computing powers that far outreach our present capacity and is likely to generate many technological spin-offs. Its projected completion date of 2025 along with its probable lifespan of some 50-100 years, means that we are building the SKA for several generations to come: an exciting concept indeed for science educators and their students.

SCIENCE AND SCIENCE EDUCATION: KEY TO A GOOD FUTURE FOR OUR PLANET

Lynn Beazley

It is my pleasure to speak as Chief Scientist of Western Australia, a region, as for Borneo, that is an internationally recognised bio-diversity hot spot as well as being a centre for the resources and agricultural sectors. I will draw on examples world-wide to illustrate the key role of science, technology, engineering and mathematics teaching. I will outline some exciting developments, many with crucial educational components, to protect biodiversity. I will draw on programs that are saving marsupials once thought to have become extinct, protecting unique orchids and learning the secretive ways of the largest fish in the sea, whale sharks, as they navigate the world's oceans. I will describe programs that tackle threats to the environment and to biodiversity including fire, invasive pests and diseases, and a changing climate. Other key areas I will touch upon are sustainable approaches towards global food security, renewable energy generation and a healthier human population. These are just some of the examples of how the teaching professions can stimulate in our young people an awareness of the challenges and opportunities before us, to instil a love of knowledge as well as to nurture the future leaders in research and innovation. It is all about shaping a good environmental, economic, social and cultural future for our planet.

INFORMAL SCIENCE LEARNING THROUGH MEDIA: A COMPARISON BETWEEN MALAYSIAN AND BRITISH ADVERTISEMENT CHARACTERISTICS

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Scientific literacy which involves public understanding of science can be spurred through media. Young people's affinity to media makes it more plausible to incite informal science learning through this platform. However, scientists value objectivity while media people emphasize imagery and metaphor that entertains [1]. Thus, there exists inaccuracy and misrepresentation of science facts delivered through media that can also be attributed to cultural and societal differences. This study investigates how media, specifically advertisements propagate science knowledge in Malaysia and in the United Kingdom (UK). It compares the characteristics of both electronic and print advertisements published. It also examines the accuracy of the science content elaborated and displayed by media in both countries. Data were obtained through observation of electronic and printed media, as well as through interviews with a purposely sampled group of educators. The research highlights a number of similarities with regard to the way science content influences the public, including in terms of instigating misconceptions. The difference between the UK and Malaysian commercial advertisements is that the UK advertisements tend to be more educational in nature, highlight environmental concerns and promote health awareness. Whilst in Malaysia, there is still a lack of focus on the aforementioned issues. Malaysian advertisements do contain scientific knowledge such as the pervasiveness of bacteria in daily life despite relentless exaggeration of scientific facts. The findings contribute to the design of the Malaysian pre-service science teacher's education in which informal learning from the environment is to be taught as a methodology to disseminate science knowledge to young learners.

Keywords: Informal learning, media, science education, science teacher education.

KULPARTI CALAMITY – (OR SAVING REMNANT BUSHLAND THROUGH TEACHING BIOLOGY)

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Teaching Science with direct relevance to students' lives can invoke commitment and passion for knowledge above 'regular' classroom teaching. Involving my Year 6 students in learning about the original biodiversity of our creek before the building of our school, led them to develop a plan to start restoring our weed infested creek. Use the practical program presented here, to start your classroom journey towards understanding the 'big picture' concepts of your local bushland, forest or waterway. Our program included rubbish collection, liaison with the local council rangers, learning about Dieback disease (*Phytophthora cinnamomi*) and a practical field day to treat trees in the neighbouring reserve against this disease. Students were amazed to find out that we should have tortoises living in our creek, horrified at the amount of rubbish the local public dumps in our creek and surprised at how hard it is to remove weeds! More importantly, they understand that every small action we take will help to gradually restore the biodiversity of our creek.

HEAT- SUCCESSFULLY TEACHING THIS CHALLENGING CONCEPT TO JUNIOR PRIMARY STUDENTS!

Mady Colquhoun

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We cook with it, prefer different amounts of heat in our daily weather and dress to suit the temperature but do we really understand heat enough to teach it to young students? I have integrated Physical and Chemical Sciences concepts to enable my Year 3 students to grasp both the concept of heat, plus the practical application of their understanding in their daily life. I discovered that even the words cool, cold, warm and hot held radically different meanings for the students at the beginning of the program but by the end of our learn journey, students were able to scientifically explain the reason why we wear thicker clothes in winter, how a solar oven traps heat and why ice-cream melts in your mouth. My program is freely available for you to use with your students.

ISOLATION AND CHARACTERIZATION OF ENDOPHYTIC FUNGI FROM AGARWOOD

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Research on endophytic fungi from *Aquilaria* sp. has been accomplished by many researchers. Unfortunately, in Sarawak this study is still new and need a lot of attention for further use. A study was conducted at Kota Samarahan and Baram where the samples of *Aquilaria* sp. or gaharu have been taken into Virology Laboratory for further analysis. The purpose this study is to isolate the endophytic fungi from the samples of gaharu and characterize the isolates isolated from the agarwood. This study also aims to study the potential of the isolates for inoculation and induction of gaharu resin. Ten different isolates were chosen for identification. The suspected species from identification were *Aspergillus niger*, *Trichoderma* sp., *Cylindrocladium* sp., *Trichoderma harzianum* Rifai sp., *Pestalotiopsis* sp., *Botryodiplodiatheobromae* sp., and four unknown species. For further analysis, the sample should be extracted to obtain the gene sequence of the isolates and gene relatedness identification. The study also should cover wider range of sample sites collection.

INTEGRATING CLIMATE CHANGE ISSUES IN TEACHING AND LEARNING OF GREEN CHEMISTRY AMONG THE PRE-SERVICE TEACHERS.

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Green chemistry which is also known as sustainable chemistry reflects on environmentally responsible way of teaching and learning chemistry. Predominantly, green chemistry principles have been integrated in industrial application. Specifically in designing and manufacturing new products. However, integration of these principles in education is still at infancy despite the notion education is viewed as an important tool in inculcating pro environmental values and behavior. Implementation of green chemistry is guided by its 12 principles. Based on these 12 green chemistry principles green chemistry activities and experiments were developed and adapted from various sources to tailor Malaysian chemistry and science curriculum. Green chemistry also provided a platform to integrate issues related to climate change. Specifically, in this paper integration of issues such as greenhouse gases and global warming in teaching and learning of green chemistry will be illustrated. The effect of the integration in promoting pre-service teachers' belief and willingness to act over environmental issues were measured using qualitative interview and quantitative survey. In this paper the detail outcome of the study will be provided.

RELEVANCE OF ICT EDUCATION IN NIGERIAN SECONDARY SCHOOLS

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The saying that the 21st century is driven by ICT education is not an understatement. The world population is increasing tremendously as ICT education is playing a major role to enhance the quality of life in our world. ICT education is considered to be a very important skill to possess to drive the educational development. This paper examines the relevance of ICT education in Nigerian secondary schools, specifically focusing on five Secondary schools in Katsina state Nigeria. Computers are spreading rapidly in secondary schools not just in wealthy countries, but increasingly in developing countries as well. However, although Secondary schools have had computers in classrooms for almost two decades, ways to use them effectively have evolved slowly and patchily. Secondary schools use ICTs in two main ways: for administration and routine tasks of classroom management, and for instruction. In the classroom, they have two main instructional roles: for teaching ICT skills and as a tool for teaching other subjects.

EMERGING TRENDS IN JAPAN IN EDUCATION FOR THE GIFTED IN SCIENCE AND TECHNOLOGY

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Japan has no formal educational system for gifted children. However, in 2005 Japan's Cabinet approved and established the third Science and Technology Basic Plan (2006-10), which includes "nurturing the individuality and ability of gifted (sainou in Japanese) children." Enforcement of this plan is exemplified in programs such as in "Super Science High Schools," "Next-Generation Scientists Programs," "Science Camps," and "Japan Science Tournaments." The number of Japanese participants in the Science Olympiad has increased threefold within five years. The characteristics of gifted (sainou) education in Japan are domain-specific, however, and emphasis is placed on science and technology and research and development rather than on education. On the other hand, Japanese people put great faith in the thought that giftedness can be taught. This presentation shows trends in educational policy on the gifted in Japan, and the characteristic of Japanese education for the gifted is discussed from both historical and cultural viewpoints.

**SCIENTIFIC AND TECHNOLOGICAL EDUCATION IN CHEMISTRY
LICENTIATE TEACHER FORMATION CONTEXTUALIZATION AND
SIGNIFICANCE OF SCIENTIFIC CONCEPTS IN COMMERCIAL MOVIES**

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The text discusses the use of commercial films in the early formation of Chemistry teachers as a methodological resource for the contextualization and significance of scientific concepts. This research made possible the reflection on space and time to appropriate scientific knowledge in the elaboration and development of strategies for the formation of teachers who research and reflect on their professional practice since their licentiate degree. In the Pedagogical Project of the Chemistry Licentiate Course at the Farroupilha Federal Education Institute - Panambi, RS, Brazil Campus, Integrating Projects (IP) are carried out aimed at broadening the articulation of theory and practice, valuing individual and collective research. The IP are collectively elaborated by the teachers of the subjects for the semester and developed by the undergraduates according to the class hours available for each subject with systematization and sharing of the resulting productions at the end of the semester. One of these IP with 60 class hours was developed in the first semester of 2012 with the theme of the use of commercial films in elementary education Chemistry classes. The resulting research from the reflexive observations throughout the development of this IP was guided by the following question: can studying commercial films deepen the scientific and technological education of chemistry undergraduates by creating new significance contexts of scientific contexts

UNDERSTANDING EINSTEINIAN PHYSICS: YEAR 11 STUDENTS LEARNING GAINS AFTER AN INTENSIVE ONE-DAY PROGRAM

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Einsteinian physics has rarely, if ever, been part of the school curriculum because it is considered too conceptually difficult and beyond the ability of students. In this paper we present research results, which counter to this prevailing assumption, and show that, on the contrary, students can grasp these concepts with the help of enthusiastic teachers, teaching aids and suitable resources. We tested 28 students before and after a one-day enrichment program at the Gravity Discovery Centre (<http://www.gravitycentre.com.au/>) to determine their prior knowledge, subsequent ability to understand some Einsteinian concepts, and their attitudes toward the program. Students showed strong gains in conceptual understanding of curved space with gain percentage 390%. Regarding attitude, 86% of students indicated that they would have preferred to learn Einsteinian physics before or at the same time as learning Newtonian physics. Finally, when asked what they found most interesting and most difficult, many students gave the same answer to both questions. This supports the idea that students enjoy intellectual challenges and hence teachers can use challenges to motivate students' learning.

THE CHALLENGE OF TEACHING BASIC SCIENCE AND TECHNOLOGY (BST) IN NIGERIAN PUBLIC SCHOOLS: A CASE OF ANAMBRA STATE.

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This study investigated the challenges constraining effective teaching of BST in Nigerian public schools with emphases in Anambra State. A research question guided the study which adopted a descriptive survey design. A sample consisting of 661 was selected from a population of 6615 BST teachers in the state by proportionate stratified random sampling. Questionnaire on BST teaching developed and validated by the researchers was used for data collection. The Questionnaire with an index of 0.75 was adjudged reliable and usable for the study. Data were analyzed using simple mean ratings. Results indicated among others that: i. BST curricular materials were adequately provided to schools. ii Libraries and standard laboratories and basic equipments for BST were not available in schools. iii There were paucity of specialist BST teachers, who are equally poorly motivated. Iv Methodological shortcomings including non-exposure to Information and Communications Technology (ICT) facilities were identified. Recommendations based on these findings were made.

IT TAKES MORE THAN BRAINS TO TRUST A SCIENTIST'S STORY

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The International Science Olympiads are known as the “Olympic Games” for the brightest and best of the youth from all around the world. Taking place annually, the Olympiads are venues for excelling, competing and reaching out to others. This paper describes some of the characteristics of students who come to the Australian Science Olympiad summer camp, their interest in science as presented in the media, perceptions of science careers, and career aspirations. The Science Olympiad students are highly motivated, enjoy science presentations in the media, books and news. In all measures of science interest in science and interest in science as a career, Science Olympiad students show significantly more positive responses than an age matched control group with one exception: fewer Science Olympiad students would „trust the word“ of a scientist compared with their peers.

HETEROLOGOUS EXPRESSION OF ALCOHOL DEHYDROGENASE (MSADH1) IN PLANT SYSTEM

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Alcohol dehydrogenase (ADH) is an enzyme involved in pathways that respond to various stresses including environmental such as osmotic, wound and anaerobic condition. ADH is capable of catalyze the interconversion of alcohols to their corresponding aldehydes or ketones. Recently, Adh1 activity has been identified in various sago palm tissues and a full construct of Adh cDNA (msAdh1) with approximately 1.3 Kb in length has been generated through rapid amplification of cDNA ends (RACE) technique. To further investigate the function of msAdh1, msAdh1 cDNA of approximately 1.1 Kb in length with the addition of 8x histidine codon on the 3' of the sequence was constructed and cloned in the binary vector; pGSA1131. The recombinant plasmid; pGSA1131/ msAdh1 was then transferred into *Agrobacterium tumefaciens* strain LBA4404 and subsequently used for tomato seeds transformation.

THIOUREA DERIVATIVES AND THEIR COPPER (II) AND NICKEL (II) COMPLEXES WITH ANTIBACTERIAL PROPERTIES

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Thiourea derivatives have been widely studied and contributed as one of the pharmaceutically important molecules. Synthesis of thiourea bearing various amino acids has started to gain interest among researchers. This is due to the presence of dual functional groups which associated to various biological activities. In this paper, we reported on the synthesis of novel thiourea derivatives [RC₁₁H₁₃O₄N₂S] with amino acids where R = [CH₂COOH] and [CH(CH₂C₆H₅)COOH] as well as their Copper (II) and Nickel (II) complexes. Chemical characterizations were performed via IR, ¹H and ¹³C NMR. All the synthesized compounds have shown significant antimicrobial activities against wild-type E. coli ATCC 25922.

BUILDING SCIENCE AND TECHNOLOGY CAPACITY THE CASE OF CRDF GLOBAL

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For more than a decade CRDF Global has engaged innovators, entrepreneurs and research communities worldwide to address critical challenges through science and technology programs – from the health and environmental sectors, to security and higher education. Development challenges abound across developing and emerging economies. Yet challenges associated with rapid population growth and a growing demand for improved capacity and opportunity also present tremendous possibilities for promoting the indigenous capabilities and entrepreneurial spirit. CRDF Global’s past and ongoing work has sought to address these challenges through the improvement of higher education and local research communities. Increasing the availability of knowledge and research, strengthening entrepreneurship and technological development, enhancing the professional skills of scientists and engineers, in addition to international collaborations are all core pillars of the organization’s work. The case study explores the challenges confronting higher education, focusing particularly upon science and technology, and details further the initiatives to which CRDF Global has lent its resources and expertise.

IMPROVISING TRADITIONAL METHODS AND DEVELOPING NEW INSTRUCTIONAL TECHNIQUES FOR EFFECTIVE LEARNING OF PHYSICS

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Physics is the study of matter, energy and their interactions. It inspires young people and expands the frontiers of our knowledge about Nature. Physics generates fundamental knowledge needed for the future technological developments and improves quality of life by providing the basic understanding necessary for developing new instrumentation and techniques. But decreasing trend in the number of physics students at University level is a matter of concern in many countries around the world. The reason could be the general lack of understanding of the subject, it's inherent difficulty and reliance on mathematics which tends to discourage a student from studying physics. Teaching and learning physics are challenging tasks. While traditional methods have led to frequently disappointing results, new and innovative methods of teaching physics can be adopted to develop an interest among the students in learning physics. The aim of this article is to develop innovative practices in physics teaching, to motivate the students to learn physics and to improve the quality of physics teaching.

CREATIVE PROBLEM SOLVING IN ACTION – A PILOT COURSE FOR TEACHER STUDENTS

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Creativity is described in Finnish national core curriculum and in other directional documents. Using creativity and to be innovative may be understood as important future skills. Teachers and teacher students need more knowledge about how to use and how to support creative problem solving in all subjects. Different teaching tools should be practised already more during the studies.

Goals of the pilot course has been to get familiar with creative problem solving process – as teaching tool for multi- and cross dimensional teaching (among others sustainable development teaching) and to help students to understand and to use creative problem solving.

Two research questions were asked: how students understanding about creative problem solving is developed during the course; and are students confident to use creative problem solving tool, as teachers, after the course.

Pilot course was optional (3 credits) and open for all students (all subjects and all grades). There were 11 participants (subject teachers and class teachers from grades 1-5). Course was organized by non-profit organisation Kerhokeskus with Turku University, Rauma teacher training department and course leaders came from Kerhokeskus.

Course is based on creative problem solving model according to Sahlberg et al. (1994). In theoretical framework was handled: context variety and problematic of concepts, tolerate uncertainty, creative problem solving process, supporting creative atmosphere and attitudes, how to work together, fact that creative problem solving can be used everywhere and in all subjects - it is crucial to find the right question and variety of assessment. Students practised own problem solving according to creative problem solving phases: finding the question, define question, describe the framework of own question, working on solution, assessment and presentation.

According to mind map analysis, students own understanding about creative problem solving is developed from images what creative problem solving is to images how I can use it and for what I can use creative problem solving. According to feedback sheets among others most important result was to understand importance and variety of assessment during the creative problem solving process. Also mentioned in feedback as positive was dealing with own problem, variety of assessment and a lot of different exercises and practises. Among others for development was suggested more group discussions and more examples from good practises.

In preliminary analysis is seen that beside traditional courses other courses with different structure are needed, courses where acting comes first and theory just supporting, are needed in teacher training, courses where students can solve problems hailed from own personal interest are needed and variety of assessment should be more discussed during the teacher training.

NEXT GENERATION SCIENCE STANDARDS: STIMULATING CHANGE IN US SCIENCE EDUCATION

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Science education in the United States is in the midst of a revolution in terms of what is expected of students in all grade levels and, perhaps more importantly, of teachers and science education leaders. New national standards are being written and are scheduled to be released in final form in April 2013. To date public drafts have been circulated and these indicate that the new standards, called the Next Generation Science Standards (NGSS), will set a high bar for both students and teachers. The proposed session will describe the Next Generation Science Standards process, review the major tenets of the Next Generation Science Framework and provide examples of Next Generation standards for the participants. The session will also lay out the challenges inherent in increasing rigor in science education, in particular the demand it creates for more and better professional development for teachers and administrators. The author of this paper was one of the writers of the 1995 US National Science Education Standards and is one of a five-member review team for the Next Generation Science Standards under the auspices of the National Science Teachers Association

CONCEPTUAL MEDIATION – A SIMPLE WAY OF TACKLING MISCONCEPTIONS

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Misconceptions in science occur throughout a variety of topics such as astronomy, biology or chemistry and can occur at any level from grade 7 through to senior years. Addressing scientific misconceptions within a classroom setting can be challenging. Conceptual mediation is one tool which, when used effectively, can help students to overcome any scientific misconceptions they may have. In this workshop, delegates will explore ideas on how to identify students that hold misconceptions incorporating technology. Delegates will look at the ‘Stroop effect’ and how it relates to why some students simply refuse to let go of their misconceptions as well as a simple strategy to assist students in overcoming their misconception.

LIPID ACCUMULATION IN ASPERGILLUS NIGER CULTURED IN DIFFERENT GLUCOSE CONCENTRATION

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Many fungi species are increasingly reported as good Triacylglycerols (TAG) producers, and, they are able to accumulate lipids above 50% of their biomass on dry basis. In our study, we employed the filamentous fungus *Aspergillus niger* as the lipid accumulating fungus. The *A. niger* cultures were grown in different concentration of glucose solution in order to determine the lipid accumulation. Two different glucose concentrations were used in this experiment, namely, 2.5% (w/v) of glucose solution and 5.0% (w/v) of glucose solution. From our study, we found that the best concentration for lipid accumulation in *A. niger* was 5.0% (w/v) of glucose solution because the increase in glucose solution induced more lipid production in the *A. niger*. The result shown 0.075 g/L of lipid was collected in 5.0% (w/v) of glucose solution whereas in 2.5% (w/v) of glucose solution, 0.050 g/L of lipid was collected.

Keywords: Triacylglycerols (TAG), biomass, *Aspergillus niger*, glucose solution, lipid.

APPLICATION OF THE REAL-TIME POLYMERASE CHAIN REACTION IN THE DETECTION AND ENUMERATION OF VIBRIO CHOLERAE FROM SHRIMP PONDS

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Cholera is an enteric disease which has the potential to cause severe pandemics. It is caused by a bacterium known as *Vibrio cholerae*. This project focused on the use of Real-Time PCR (RT-PCR) to detect and enumerate the presence of *V. cholerae* from selected shrimp ponds from Asia Aquaculture Sdn. Bhd in Bako Kuching, Sarawak. For this purpose, repeat in toxin (rtxA) gene was used as the target gene to determine the presence and concentration of *V. cholerae* in the shrimp ponds. The data from the RT-PCR analyses were then used to establish the dynamics of *V. cholerae* populations throughout the shrimps culturing period. From our study, the results showed that the *V. cholerae* population densities was on a decreasing trend in all ponds sampled. For Pond 1, the regression profile was supported by an R² value of 0.85. Initial *V. cholerae* density was at 6.31×10^3 cells/ml at week 1, and decreasing to approximately 2.42×10^2 cells/ml at week 12. For Pond 14, the decreasing trend was similar (R² = 0.68) with initial *V. cholerae* density at 1.76×10^4 cells/ml at week 1, decreasing to approximately at 1.57×10^3 cells/ml at week 12. All analyses were done in less than 3 hours upon sampling. Therefore, we believe that RT-PCR assay allows for more rapid detection and identification of *V. cholerae* which is faster than current conventional assay.

Keywords: *Vibrio cholerae*, Real-Time Polymerase Chain Reaction (RT-PCR), rtxA, Shrimp Ponds

PREVALENCE OF ESCHERICHIA COLI AS INDICATOR BACTERIA IN RIVER WATER OF SG. SARAWAK

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The study of the prevalence of *Escherichia coli* as indicator bacteria was carried out in Sg. Sarawak, which involved four stations. The number of bacteria colony was measured in CFU/100ml unit and relate to the water quality parameters such as pH, DO, FCC, TCC, and temperature. The presence of the *E.coli* and other bacteria is related with the human activities nearby the river. The drivers of the microbial contamination were studied based on community practiced of the household waste. Indirectly, the environmental awareness among the community was measured based on participation in river activities, the opinion about river and daily practice that bring the effect to the river. From the study the level of *E. coli* was highest at Satok Bridge station which was 90 CFU/ 100ml. This is due to the improper sewage disposal from residential area, low flow of the river, existence of municipal waste from local wer market, and domestic wastes. Meanwhile, the highest TCC and number of bacteria were identified at Waterfront Kuching stations which were 415 CFU/100ml and 3372 CFU/100ml, respectively. The common practice of the community that settle nearby the river was 18% of the respondents involved in the questionnaires survey thrown domestic waste into the water, and 49% of the respondents channelled the liquid waste directly to the river as well as the discharge of human waste into the river was 18% of the respondents. Lack of education and awareness campaigns on river pollution, has led to low environmental awareness about effective and correct practice to protect and conserve the river. The respondents opinions about river was 39.22% of them mentioned the river was polluted with a lot of waste found on the water surface.

YOUTUBE A USEFUL CHANNEL FOR INFORMAL SCIENCE EDUCATION?

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Youtube has enormous potential to be used in informal science education. However, so far there is very little evidence on whether watching short, entertaining videos could actually influence viewer attitudes or behaviour. We studied the influence of short (50 second) Youtube clips on aquarium owners' attitudes and behaviour toward fish care. Videos significantly increased the number of times owners cleaned their tanks if they already had positive intentions towards tank care, although attitudes did not change. This fits with Ajzen's Model of Planned Behaviour, which states that intentions are the best predictor of behaviour. Our research suggests that Youtube videos are useful for strengthening weak pre-existing intentions, but are not a sufficiently strong intervention to influence viewers who are already strongly committed or are completely uninterested.

THE ESWN WEBPAGE AS A TOOL TO INCREASE INTERNATIONAL COLLABORATION IN THE EARTH SCIENCES

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The Earth Science Women's Network (ESWN; ESWNOnline.org) is an international peer-mentoring network of women in the Earth Sciences, many in the early stages of their careers. ESWN's mission is to promote career development, build community, provide opportunities for informal mentoring and support, and facilitate professional collaborations. This has been accomplished via email and a listserv, on Facebook, at in-person networking events, and at professional development workshops. Over the last 10 years, ESWN has grown by word of mouth to include more than 1600 members working on all 7 continents. In an effort to facilitate international connections among women in the Earth Sciences, ESWN has developed a password protected community webpage where members can create an online presence and interact with each other. For example, regional groups help women to connect with co-workers at the same employer, in the same city or the same country, or with women at the place where they are considering taking a new job, will attend a conference or will start working soon. Topical groups center around a vast array of topics ranging from research interests, funding opportunities, work-life balance, teaching, scientific methods, and searching for a job to specific challenges faced by women in the earth sciences. Members can search past discussions and share documents like examples of research statements, useful interview materials, or model recommendation letters. The new webpage also allows for more connectivity among other online platforms used by our members, including LinkedIn, Facebook, and Twitter. Built in Wordpress with a BuddyPress members-only section, the new ESWN website is supported by AGU and a National Science Foundation ADVANCE grant. While the ESWN members-only community webpage is focused on providing a service to women geoscientists, the content on the public site is designed to be useful for institutions and individuals interested in helping to increase, retain, promote, and advance women in the geosciences. Information on gender bias issues, as well as strategies to overcome these biases, is included. We also share gained knowledge with a broader audience, such as lessons learned at our professional development workshops, collected recommendations from members of podcasts, science books, writing materials, and resources for early career faculty. At the same time we provide a platform to highlight women in the Earth sciences, and links to our own and outside content in the form of, for example, Youtube videos, blogs, and Twitter feeds related to women geoscientists.

WORKSHOP: UNDERSTANDING NETWORKS AND THE IMPORTANCE OF NETWORKING MIRJAM S. GLESSMER AND ROSE KONTAK

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The Earth Science Women's Network (ESWN; ESWNOnline.org) is an international peer-mentoring network of women in the Earth Sciences, many in the early stages of their careers. ESWN's mission is to promote career development, build community, provide opportunities for informal mentoring and support, and facilitate professional collaborations. This has been accomplished via email and a listserv, on Facebook, at in-person networking events, and at professional development workshops. Over the last 10 years, ESWN has grown by word of mouth to include more than 2000 members working on all 7 continents. We propose a session in which we introduce participants to the importance of networking and invite them to find out more about ESWN.

The overarching goal of the proposed workshop is to empower women working in Earth Sciences to successfully progress into senior position and take on leadership roles. Women in Earth Sciences often perceive a sense of isolation, and certainly a lack of role models or understanding of the difficulties facing women in the workplace. The absence of a community of women in the discipline can result in a lack of collaborations among women, and less networking and recognition by others in their fields. This isolation contributes

to a deficiency of social capital, and can lead to lower productivity and lower success rate. Awareness of the importance of networks and expanding women's networks can contribute to overcome these obstacles and have been shown to increase women's participation and retention in science. In fact one of the largest recognized needs for women students is a feeling of connection with others in their fields. The workshop consists of three parts. In the first part, we introduce some facts about networking and about how networks function. This is done through a short presentation followed by an activity. This is then followed by a second part, where we introduce participants to the concept of "mapping their network" in order to identify in which regions they already have a strong network and where there are still gaps. In the third part, in another activity, we mix up participants and demonstrate who of the other participants has similar interests and would be a good match to network with on specific aspects. Ideally, this workshop is followed by a reception where participants have the chance to deepen the new connections.

A NEW ARRANGEMENT FOR CULTIVATING PRIMARY STUDENTS IN METACOGNITION

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This presentation shows an attempt to cultivate students in metacognition in a science lesson. A teacher, one of the present authors, aims at having students realize how different factors may interact to influence their own thinking. Such factors that students realize can be properly called an aspect of metacognitive knowledge. He arranges the lesson according to inquiry-based learning as usual in Japan; however, he assures students of a few opportunities to revise their hypotheses or forecasts in experiment still in progress. This is the essence of the new arrangement of his. Normally, in a science lesson according to inquiry-based learning in Japan students are assured of a single opportunity to form a hypothesis or a forecast just before their experiment on an issue that the teacher has shown. In this setting for inquiry-based learning, it is difficult for students to become aware of those factors that may interact to influence their own thinking. A single opportunity is not enough for students to realize the factors. Because inquiry-based learning implies one trial and error after another, the present arrangement is suitable for achieving what inquiry-based learning really means and at the same time for cultivating students in metacognition.

EDUCATING THROUGH MOBILE APPLICATION FOR NATIONAL PLANETARIUM

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Planetariums are always looking for the best way to engage audiences. Mobile technology is advancing quickly and smartphones are quickly becoming commonplace. A planetarium smartphone application can provide visitors with a more immersive, engaging, and informative experience than can be had with traditional planetarium learning tools. Mobile technologies are becoming more important as generations of young people are becoming accustomed to absorbing all kinds of information from handheld and electronic devices. By embracing new technologies, planetariums are indicating that they understand the learning styles and interests of their visitors. Building an application that can run on any smartphone platform will allow the planetarium to reach the largest possible audience. This research project is targeted the utilization of application mobile technology at National Planetarium Kuala Lumpur.

Keywords: Mobile app, planetarium learning, smartphone, visitor engagement, mobile technology

A STUDY OF IMMERSIVE DIGITAL THEATRE

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Nowadays digital content plays important role for theatre quality and enhancement. Technology trend revolves rapidly from using mechanical (analog) system to computerized (digital) one. However, different system supports different capability and format. Currently in Malaysia, we have several planetariums with digital theatre but operating in different system and format. This study is conducted to find a solution in a way to build up a standard dome format for space theatre content sharing among those planetariums. For the time being, survey forms that consist of related dome configuration format was submitted and verbally spoke to all planetarians in-charge. Some collaboration and workout were made between SkySkanInc and National Planetarium regarding the existing dome format configuration.

Keywords: planetarium, immersive, fulldome, learning, education

**COMPARISON OF MIMOSINE CONTENT AND NUTRITIVE VALUES OF
LEUCAENA LEUCOCEPHALA, NEOLAMARCKIA CADAMBA AND
MEDICAGO SALIVA (ALFALFA) AS FORAGE QUALITY INDEX**

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A study was conducted to compare mimosine content and nutritive values of *Leucaena leucocephala*, *Neolamarckia cadamba* and *Medicago saliva* (Alfalfa) as forage quality Index. Exactly 120 seeds were used for each species and for alfalfa from the previous study to determine the mimosine content and to improve the nutritive value after 6 months of planting. It was noted that the mimosine content was highest in *leucaena* (1600.06 ppm) and lowest in *Neolamarckia cadamba* (0.33 ppm). Alfalfa did not contain any mimosine. Crude protein content was 23.48%, 20.90% and 14.83% for *leucaena*, *neolamarckia* and alfalfa, respectively. The crude fiber was maximum in alfalfa (27.23%) and minimum in *leucaena* (18.77%). Crude protein, crude fat, gross energy, protein to energy ratio, organic matter and ash in *Neolamarckia cadamba* was higher compared to alfalfa. The mimosine content in *Neolamarckia cadamba* was much lower than *leucaena*. *Leucaena leucocephala* was lower in nitrogen free extract, crude fiber and ash compared to *Neolamarckia cadamba*. Results from this study indicated that *Neolamarckia cadamba* has high forage quality and comparable to the traditional *Leucaena leucocephala* and *Medicago saliva* as forage for ruminants.

Keywords: *Leucaena leucocephala*, *Neolamarckia cadamba*, *Medicago saliva*, crude fat, crude protein, forage.

**BIOLOGICAL CONTROL OF PLANT PATHOGENIC FUNGI,
COLLETOTRICHUM SP.**

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Colletotrichum is one of the most common and important genera of plant-pathogenic fungi. Members of this genus causes major economic losses, especially on fruits, vegetables, and ornamental product. To reduce these losses, control of Colletotrichum is required such as the use of chemicals. Nevertheless, to control the fungal diseases attack biological control approach is a more preferable option and environmentally friendly as compared to the use of chemical products. The present work was carried out to study the potential use of bacterial microfloras biological control agent. The findings showed *Pseudomonas* sp. to be antagonistic in vitro, inhibiting or reducing the growth rate, towards *Colletotrichum capsici* in the dual culture plate assay experiments. Non-volatile antibiotics and lytic enzymes were also secreted by *Pseudomonas* sp. that may be responsible in the inhibition and reduction in the growth of *C. capsici*.

MOLECULAR APPROACH IN DETERMINATION OF CONTRIBUTORY FACTORS IN TRUNKING AND NON-TRUNKING SAGO PALM

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Sago palm (*Metroxylon sagu*) is one of the important commodity plants which contribute to the economy of Malaysia with an export value of RM91,344 million in 2011. Some sago palms do not grow normally where it stays at rosette stage even after 12 years of plantation especially in the deep peat soil. This phenomenon eliminates the economic value of the palm. Transcriptomic, metabolomics and starch morphology characterization approaches has been used to identify the differences between trunking and non-trunking sago palm. Differences between the two morphologies were seen in Representational Difference Analysis (RDA) of RNA expression, Nuclear Magnetic Resonance (NMR) pattern of the metabolite content and starch morphology.

Key: *Metroxylon sagu*, sago, NMR, metabolite, starch, RDA

BEATING THE LANGUAGE BARRIER IN SCIENCE EDUCATION: IN-SERVICE EDUCATORS' COPING WITH SLOW LEARNERS IN MAURITIUS

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In the Republic of Mauritius, there are about 9000 pupils (aged 11-12 years) who fail the end of primary level examinations even after the second attempt. These pupils cannot follow the pace of mainstream students due to their poor language and other skills, so they are sent to pre-vocational schools. They follow a diluted curriculum and learn basic technical skills along with core academic subjects. This study describes how in-service teachers in the pre-vocational sector of education in Mauritius adopted specific strategies to overcome the language barrier in the learning of science among low ability children (Van Driel, Verloop & de Vos, 1998). Students were taught basic concepts in "Earth & Space", like 'occurrence of day and night', through use of role play and ICT. They were then assessed using structured worksheets and visuals. Classroom observation, focus group discussion with students, interview with educators and post-test with students, show that role play and ICT can overcome the language barrier in the learning of science among low ability learners. Findings reveal that reading and writing should be kept to a minimum while the use of Mother Tongue and hands-on activities, along with oral interactions, must be encouraged during science lessons.

TEACHER FACTORS AS CORRELATES OF ATTITUDES TO BASIC SCIENCE TEACHING AT THE BASIC EDUCATION LEVEL IN OGUN STATE, NIGERIA

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Achievement in Basic science and technology (BST) and subsequently the enrolment in science subjects at higher level is still very low. It is therefore necessary to find out how teacher factors like qualification, age, experience and gender affect teachers' attitude to teaching BST, since it has been established that teachers' positive attitude to teaching will lead to improved achievement. Research findings have over time indicated that teacher factors are very important in science teaching at all levels. This research work sought to find the composite and relative contribution of four independent variables (qualification, age, experience and gender) on a dependent variable, teacher's attitude to teaching Basic Science and Technology. The findings of the study revealed that majority of the teachers do not enjoy teaching BST, they employ methods which should not be majorly in use at this level of education and would prefer to teach other subjects other than BST. Of the four teacher factors, gender contributed most to the attitude of teachers to the teaching of Basic Science and Technology.

SCIENCE EDUCATION OF CAST

Ms. Xinyuan Hu

The China Association for Science and Technology (CAST) is the largest national non-government organization of scientists and technologists in China. Through its member societies - 181 in number - and local branches all over the country, the organization maintains close ties with millions of Chinese scientists, engineers and other people working in the fields of science and technology. There are quite a number of service institutions to help implement the decisions made by the leading organs of CAST, such as Children & Youth Science Center(CYSCC), China Research Institute for Science Popularization(CRISP), China Science and Technology Museum, Popular Science Press, etc.

MALAYSIAN AND STEINER WALDORF SCIENCE CURRICULAR PRACTICES: A COMPARATIVE STUDY AND IMPLICATIONS FOR THE DESIGN OF SCIENCE TEACHER EDUCATION

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The National Science Education Philosophy in Malaysia emphasises on nurturing a Science and Technology culture by focusing on the development of individuals who are competitive, dynamic, robust and resilient and able to master scientific knowledge and technological competencies. However, the way science curriculum is implemented in schools has been claimed as the cause of unsuccessful achievement of the mission and vision of Malaysian science education. On the other hand, the Steiner Waldorf curriculum is known for its educational emphasis on creativity and development of students. This paper reports a study conducted by a group of Malaysian teacher educators and teacher trainees to compare the curricular practices in science education, namely the Malaysian Integrated Science Curriculum and the Steiner Waldorf curriculum. It investigates the science curriculum of Steiner education in the United Kingdom (UK) and compares the Steiner with the Malaysian science curriculum. The research employs qualitative approach whereby data were obtained primarily through interviews and observations. General findings suggest that both public Malaysian and UK schools adhere strictly to a prescribed curriculum; teacher-oriented and the focus is given by the teachers to complete the syllabus and student's assessment. On the contrary, Steiner education has its own science curriculum which is dissimilar to other public schools in the UK albeit all their students will later have to sit for the same GCE O and A levels. Other findings suggest that the science taught in Malaysian school appear to be content-laden and puts emphasis on theoretical before practical aspects while Steiner classrooms are more pragmatic, creative and practical-based, with the theories being covered much later after the students have conducted their own experiments on specific science topics. Cultural differences in learning are also observed between the Malaysian and Steiner classrooms. The paper highlights the strengths of both curricular practices that can be extracted to design an effective and viable science education teaching module for Malaysian teacher trainees. Guidelines for such a module will be presented as the recommendation of the research.

Keywords: Curricular practices, Science education, Steiner Waldorf education, teacher education.

USING DOCUMENTARY MOVIES FOR DEVELOPING 8TH GRADE STUDENTS' UNDERSTANDING ABOUT SCIENCE AND NATURE OF SCIENCE

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This quasi-experimental study investigates the effects of documentary movies on students' understanding about science concepts and nature of science (NOS). One hundred thirteen student in four eight-grade classes participated in this study over a 6-week period, during which the topics related to "Cell Division and Heredity" and "Force and Motion" were covered as a part of the Turkish Science and Technology Curriculum. Two different modes of treatment were used. In the experimental groups, students watched six documentary movies in their science and technology lessons: "Science and Life-Mendel", "Science and Life-DNA" and "Charles Darwin and the Tree of Life" for the lesson unit of "Cell Division and Heredity" and the documentary movies of "Archimedes" "Wright Brothers How was plane invented" and "First Flying Tests" for the lesson unit of "Force and Motion". These movies were about 10 minutes long and were embedded into the Science and Technology Curriculum. As for the control group students, they were taught the science lessons in line with the Science and Technology Curriculum. Students' views of NOS were assessed by the administration of the Views of Nature of Science Questionnaire (VNOS-E) and their understanding about "Cell Division and Heredity" and "Force and Motion" were assessed by the administration of a 20-multiple-choice achievement test. In addition, semi-structured interviews were held with 14 students (7 students from the experimental group, and 7 students from the control group) by using VNOS-E at the beginning and end of the study. The results showed that there was no significant difference between the control and experimental groups students' understanding about "Cell Division and Heredity" and "Force and Motion." The results also revealed that there was no significant difference between pre- and post-tests results regarding to the control group students' views about the aspects of NOS. Nonetheless, there was a significant difference between the pre- and post-tests of the experimental group students' views on the following aspects of the NOS: tentativeness of NOS, (NOS-1), empirical aspect of NOS (NOS-2), subjective nature of scientific knowledge (NOS-3) and the creative and imaginative nature of scientific knowledge (NOS-4). No significant difference was found in the differences between observation and inferences (NOS-5). In addition, there was a statistically significant difference between the post-tests of the experimental and control group students' views about the four aspects of the NOS (NOS-1, NOS-3, NOS-4, NOS-5); however, no statistically significant difference was found between the posttests of their views about one theme (NOS-2). The present study suggests that the use of documentary movies in science classrooms promote students' views about NOS.

Keywords: Nature of Science, Context-specific activities, Documentary Movies

ALTERNATIVE CONCEPTIONS IN BIOLOGY AMONG BENUE STATE SECONDARY SCHOOL TEACHERS AND STUDENTS: IMPLICATIONS FOR BIOLOGY TEACHING AND LEARNING.

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This paper considered the problem of alternative conception of Biology concepts among Tiv and Idoma students in Benue State, Nigeria. Thirty biology teachers and 300 (150 Tiv and 150 Idoma) students, were purposively selected from fifteen schools out of the twenty two secondary schools in Makurdi LGA of the State. Two semi-structured questionnaires for teachers and students were peer reviewed and subjected to face and content validity by a panel of experts who made useful suggestions. Frequency counts and simple percentages were used to analyse the data. The results showed that majority of the teachers were aware of the problem of alternative conception and believed that it was prevalent among students in the schools. The study also identified a number of alternative conceptions by students across the two major tribes on such topics like genetics, nervous coordination, and nutrition, among others. The sources of alternative conceptions identified include; culture, folktales and peer influence while the effects include poor performance, rote learning and fears. The roles of teachers proposed include; identifying the alternative conceptions, explaining clearly scientific concepts and discouraging alternative conceptions. The recommendations include, raising the level of awareness of teachers and students on the problem of alternative conception as well as using appropriate teaching strategies that can help teachers identify and discourage alternative conception.

EVALUATION OF THE IMPLEMENTATION OF BIOLOGY PROGRAMME IN SECONDARY SCHOOLS IN BENUE STATE OF NIGERIA.

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The paper evaluated the implementation of biology programme in secondary schools in Benue State. The study employed the survey and ex-post-facto designs. Two instruments viz: Biology Programme Evaluation Questionnaires for Teachers (BPEQT), Biology Material Resources Assessment Checklist (BMRAC) were developed, validated and used by the researchers to elicit data from 170 biology teachers in 119 secondary schools randomly selected from 284 schools in the State. The sampling technique was multi-stage sampling. The study revealed among others that majority (60%) of the biology teachers were not qualified to teach biology, teaching methods often used by teachers were not the same as those recommended for teaching the subject. The study found a significant mean difference in the achievements of biology students in West African Senior School Certificate Examination (WASSCE) as well as in the provision of material resources between urban and rural schools. For effective implementation of biology programme, more qualified biology teachers should be recruited, material resources should be adequately provided and teachers should be acquainted and encouraged to use modern teaching strategies that are student centered.

ASSESSMENT OF EXPOSURE TO GROUND-LEVEL OZONE OF TRAINEE NIGERIA CERTIFICATE IN EDUCATION (N.C.E.) CHEMISTRY TEACHERS IN KANO STATE OF NIGERIA.

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Ozone is present throughout the Earth's atmosphere. It has gained much publicity as articles in print and as subject of discussion on audio-visual media. This effort has not been able to clear the confusion surrounding its nature. Ozone in the lower atmosphere is an air pollutant with harmful effects on the respiratory systems of animals. It also damages sensitive vegetation (including trees and plants), ecosystems such as forests, parks, wildlife refuges and recreation areas during the growing season. Ozone is equally the main component of smog. Tropospheric or ground-level ozone has become a significant pollutant as a result of increased population growth, industrial activities, and use of automobiles. Ground-ozone is at present, the primary air pollution problem in the United States. The adverse health effects of ozone have been studied since 1952. Ozone has been found to exert adverse effects on public health especially those living in industrialized cities. The United States Environmental Protection Agency (EPA) has classified ground-ozone as a criteria pollutant. (Seinfeld & Pandis, 1998; Ibanez, et. al, 2005; Koike, 2005; Weinhold, 2008; EPA, 2012). This paper has the overall purpose of evaluating the extent to which final year N.C.E. trainee chemistry teachers are exposed to the knowledge of ground-level ozone for environmental sustainability and related issues. Specifically, this study will attempt to answer the following research questions.

ADOPTING HUMANISTIC APPROACH TO TEACHING SCIENCE IN INCLUSIVE CLASS

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This paper is concerned with teaching of science in inclusive science classroom. The peculiarities of inclusive classroom demand the need to employ appropriate teaching method that can promote the realization of the goal of inclusive education and indeed the goal of science teaching. In this context, humanistic approach to teaching of science was advocated. The paper explores and relates inclusive education and humanistic approach to education as both aimed to putting the learner at the heart of education and of teaching. The concept of inclusive education, humanistic education and the humanistic nature of science, and the concept of humanistic teaching are explained in the context of their philosophical orientation that promotes learner-centredness. The paper identified humanistic teaching approach to involve cooperative learning, activity based lessons, peer tutoring sustained in a classroom that is socio-psychologically and physically conducive for learning and every learner to reach his or her potential in the inclusive classroom. Constrains that could affect effective utilization of humanistic approach to teaching science in inclusive classroom are teacher's pedagogical knowledge and skill, the irrelevance of science curriculum to the needs of special need students in inclusive classroom and inadequate funding. Implementable suggestions that can help in successful adaptation of humanistic science teaching in inclusive class were given.

CINEMA AS RESOURCE FOR INTRODUCTION OF THE SCIENCE HISTORY IN SCIENTIFIC EDUCATION

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This paper presents an investigation on the cinema contribution as a resource for introducing the approach of Science History in scientific education. The survey was conducted in 2010 involving high school students from two public schools. From this perspective, commercial circuit films were shown during six meetings. Using a qualitative approach, information was collected from students' perceptions about the image of science and scientists present in these films. The results indicated that the students' view of science is still generally much mythologized and guided by positivist notions. We argue that many filmic scenarios can, through their critical use, be a way of contextualization of contents and discussion of the nature of science. Thus, the introduction of the Science History in secondary education aiming at developing an adequate understanding of the nature of science can contribute to the improvement of science education.

Keywords: science education, cinema and education, history of science and education.

DECOLOURISATION OF SYNTHETIC DYES USING CRUDE ENZYMES OF AN ENDOPHYTIC FUNGUS MARASMIUS CLADOPHYLLUS MS8

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Many synthetic dyes present in industrial wastewater are resistant towards degradation and removal by conventional wastewater treatment. Despite the promising strategy of utilizing fungi and bacterial strains for dye removal, dye decolourisation using microbes however have some inherent drawbacks including long growth cycle and long hydraulic retention time for complete decolourisation. The aim of this work was to examine the possible utilisation of crude enzyme produced by a dye decolourising endophytic fungus *Marasmius cladophyllus* MS8, to achieve faster dye decolourisation. *M. cladophyllus* when grown in minimal liquid medium containing 200 mg/L of Remazol Brilliant Blue R (RBBR) dye was able to decolourize more than 80% of the dye in 6 days. Crude enzymes were then harvested from both the fungal decolourised broth and fungal broth with no dye for further RBBR dye decolourisation experiments. The results obtained shows that the percentage of RBBR dye decolourised using crude enzymes from the fungal decolourised broth was constantly higher compared to crude enzymes from fungal broth with no dye added. In addition, increased enzymes activities of both manganese peroxidase and laccase were also detected in the decolourised culture broth. Further concentrating of the crude enzyme using ammonium sulphate also allowed faster RBBR dye decolourisation, with up to 94% decolourisation (200 mg/L) in less than 24 hours. When tested on different type of dyes, the concentrated crude enzyme preparation was also able to decolourise similar concentration of Orange G dye (54%), Congo red (59%) and Methyl red (80%) all in 24 hours.

Keywords: Decolourization, dyes, fungus, *M. cladophyllus*, crude enzymes

HOUSEHOLD FOOD SAFETY AWARENESS OF FEMALE UNIVERSITY WORKERS IN SOUTH EAST NIGERIA

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This study is aimed at exploring the awareness of household food safety among female University workers in South East Nigeria. Specifically the study identified the food safety knowledge, attitude/ perception to food safety issues, food purchasing practices, food handling and preparation practices among female university workers and ways of improving household food safety practices. The study was a descriptive survey design. A structured questionnaire was used to collect data from a sample of four hundred and ninety female university workers obtained from a total population of two thousand four hundred and fifty females working in the five federal universities in the south east zone of Nigeria. Frequency and mean were used to analyze the data obtained from the questionnaire. The study revealed that the female university workers have adequate knowledge about food safety practices. However, more than half of the respondents were not aware of the role of temperature control as a means of reducing the risk of food borne illnesses. It is suggested that public health education program be designed to enhance household safety awareness.

ONLINE PROFESSIONAL LEARNING IN THE AUSTRALIAN SCIENCE TEACHERS ASSOCIATION

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The ASTA Online Professional Learning Portal was established in 2011 to be a site for teachers of science to locate and share courses and resources. As well as a range of materials provided by partner organisations there is a growing bank of presentations, teaching modules, worksheets and practical ideas which have been shared by teachers for the benefit of their colleagues. In this workshop Nigel Mitchell, ASTA manager of Online Professional Learning, will provide an overview of the educational challenges and opportunities presented by Information Technologies in schools, and outline how ASTA is responding to these. The main activity of the workshop will be an opportunity to explore the ASTA portal, and a discussion of how teachers use and contribute to the site. Participants will also be encouraged to provide feedback on how the site may be improved to better meet the needs of teachers. There is currently no restriction on participation in the ASTA Online Professional Learning Portal; the only requirement is a valid email address. Participants are welcome to setup a login on the site at moodle.asta.edu.au before or during the workshop.

TEACHERS USE OF TEXTBOOKS – A COMPARATIVE STUDY OF DISCIPLINE BOUND DIFFERENCES

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The aim of this study is to investigate teachers' use of textbooks in contemporary Swedish schools and compare whether there are differences between teachers of different disciplines. It has since long been established that the textbook is one of the main interpreter of the curricula. However the exponential growth of information and communication technology in the last decades has raised the question if there has been a paradigmatic shift in the Swedish classroom regarding this issue. The design of this study is quantitative and consists of a teacher-questionnaire. The questionnaire was distributed to 1500 teachers in Sweden that were asked about their use of teaching materials. From the results we can conclude that the textbooks retain its position as the most important teaching material. Secondary science teachers were heavily relying on textbooks while primary science teachers did not in comparison to other teachers. Our results are similar to studies from other countries. This is somewhat unexpected due to two reasons: 1) There is a common attitude within the Swedish school system that a qualified teacher should work independent from textbooks, and 2) Sweden is one of the most technique dense countries in the world that quickly adopt to new technologies.

SITE DIRECTED MUTAGENESIS OF STISA2 GENE AND EXPRESSION OF THE RECOMBINANT ENZYME IN *E. COLI*

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Isoamylase is a type of starch debranching enzyme (DBE) that debranches glucan polymers producing linear maltooligosaccharides during starch biosynthesis in plants. Three isoamylase isoforms exist, and each plays a distinct and important, but yet unclear role in starch biosynthesis. However, isoamylase isoform 2 (Isa2), lacking 6 of 8 conserved residues in the catalytic site, has no catalytic activity. Despite this, Isa2 plays an important role in starch biosynthesis, as can be seen in Arabidopsis where Isa2 null mutants produced 80% less starch and accumulated water soluble polysaccharides instead. The objectives of this work was to restore the catalytic residues by mutating the *Solanum tuberosum* isoamylase isoform 2 (Stisa2) gene, to express and purify the recombinant Stisa2 enzyme, and subsequently, test whether catalytic activity had been restored. Three PCR-based methods: overlap extension PCR, asymmetrical overlap extension, and an improved overlap extension PCR were used to introduce point mutations to substitute the identified DNA bases. After validating the mutations, the recombinant enzyme was expressed in *E. coli* Rosetta 2 under optimized conditions and expression of soluble Stisa2 was confirmed through western blot analysis. However, preliminary purification of the soluble enzyme showed no activity from the modified enzyme. In silico analysis was also carried out to investigate these properties.

Key words: Isoamylase, Starch Debranching Enzyme, Mutagenesis, Heterologous Expression

INTERACTION PATTERNS IN NIGERIAN SENIOR SECONDARY SCHOOL PRACTICAL BIOLOGY CLASSROOM

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The study investigated the interaction pattern among students and teachers in Senior Secondary School practical biology classroom. Four research questions guided the study. The study adopted a descriptive survey design. The sample was six hundred and forty-five (645) senior secondary school year two biology students that composed the eighteen intact classes from six (6) secondary schools located in Awka Educational Zone in Anambra State. The intact classes were selected through simple random sampling technique. The subjects were observed in their intact classes during their regular practical biology lessons. A modified Flander's Interaction Analysis System Instrument was used for observing and recording interaction patterns of biology students and their teachers in practical biology classroom. The mean scores were used to answer the research questions. The major findings from the study showed that biology teachers dominated the practical biology and initiated interactions with the students initiating interactions themselves. In sex segregated schools, girls interacted more frequently with biology teachers and their classmates than boys in the practical biology classroom. In coeducational schools, boys were more active and willing, interacted more frequently and dominated the practical biology classroom than girls.

THE PROMOTION AND LEARNING OF IBAN FOLKLORE

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Traditionally, Iban folklore was usually presented by storyteller who uses drums to attract listeners in longhouse for evening entertainment. These stories were often used for educational purposes, especially for the children. However, the roles of storytellers in presenting the folklore are currently seen as less entertaining, causing these literatures to be increasingly marginalized. This scenario is caused by the increasing availability of modern technology, thus, transforming the delicate Iban culture and social patterns. This research was conducted to identify the techniques on how storytelling, performance techniques by Iban storytellers contributed to the Iban community in Sarawak, and also to examine effective methods for learning and promoting these materials. Iban folklore often laced with humour, creative thinking, apart from teaching valuable moral lesson making it one of the suitable media to educate schoolchildren. From our findings, we are suggesting to the Iban communities in Sarawak to organize a better strategies and promotional techniques through advertising in prints and modern technologies such as electronic media; namely animation or short film. The promotion and learning of Iban Folklore will raise public awareness and indirectly help to preserve the Iban traditional folklore in Sarawak. Keywords: Iban Folklore, Iban Community, Storytelling, Valuable Moral Lesson, Modern Technologies, Educational Promotion, Public awareness.

CHARACTERIZATION OF ALKALINE EXPLOSION TREATED SAGO HAMPAS FIBER

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Sago hampas is one of the biomass that has a promising future as a feedstock for bio-ethanol production. However, the useful polysaccharides are embedded and linked within complex lignin structure, causing only minimal hydrolysis of sago hampas to be converted into bioethanol. Therefore, pretreatments have to be performed to further liberate these saccharides. Pretreatment will alter the complex lignin matrix and increase the feasibility of the polysaccharides to undergo enzyme hydrolysis, allowing complete hydrolysis for subsequent bioethanol production. In this study, sago hampas was subjected to physiochemical pretreatment using alkaline explosion method. The sago hampas was destarched, dried, grounded and screened using 20 mesh sieve and mixed with sodium hydroxide at different concentration ranging from 1% to 5%, based on weight basis. The mixture of sago hampas and sodium hydroxide were heated at 121 °C, 15 psi for 15 minutes and underwent rapid decompression. The mixtures were allowed to cool down and were rinsed with water repeatedly. The pH of the mixture was adjusted to 4.2 - 4.8 using concentrate sulphuric acid and oven dried for three days. The analysis of lignocellulose content of hemicellulose and cellulose hampas was done by Natural Detergent Fibre and Acid Detergent Fibre, while the analysis of lignin content was done by modified Klason lignin method. The analysis of lignocellulose content of pretreated sago hampas shows that the cellulose and hemicellulose content increase as the concentration of sodium hydroxide increase. Lignin, moisture and ash content show decreasing pattern as the sodium hydroxide concentration increase. The data obtained from this study indicated that the composition of lignocellulosic content of sago hampas was altered after alkaline explosion pretreatment.

Keywords: Sago Hampas, Alkaline Explosion Pretreatment, lignocellulosic Content, Natural Detergent Fibre and Acid Detergent Fibre.

PRELIMINARY STUDY OF MICROSTRUCTURAL CHANGES IN WOOD DEGRADATION OF ALSTONIA SCHOLARIS AND CERIOPS TAGAL HEARTWOOD

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Wood has a high demand in our society needs in construction, timber and others. However, wood is degraded against living organisms such as insects, fungi, moulds and many more. The factors that influence the wood degradation based on the temperature, food and moisture. Over the recent years, microscopy like Scanning Electron Microscope (SEM) has played a major role in improving our knowledge of the morphological aspects of biological deterioration in wood. It also had been useful tool to understand fundamental aspect of the biochemical mechanism. This study is intended to increase our knowledge of the microstructural changes which takes place in *Alstonia scholaris* and *Ceriops tagal* during degradation and where microscope has supported this understanding. *Ceriops tagal* has been exposed against wood decay fungi *Trametes versicolor* and *Schizophyllum commune* while *Alstonia scholaris* exposed with the natural environment. There is microstructural changes occur in both which take place in heartwood of the plant species. Keywords: Wood degradation; *Alstonia scholaris*; *Ceriops tagal*; *Trametes versicolor*; *Schizophyllum commune*; natural environment; Scanning Electron Microscope.

DESIGNING A WORKED EXAMPLE TO ENHANCE STUDENTS' CONCEPTUAL UNDERSTANDING OF ELECTROCHEMISTRY

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This paper reports on a study to determine the efficacy of a designed worked example following a potential model framework for a unit in electrochemistry. The design of the worked example draws upon theoretical insights into perspectives on learning and empirical studies to improve students' conceptual understanding of the conductivity in the electrolytic cell. The design tool such as the learning demands is developed in order to address the differences between students' everyday knowledge and the school scientific knowledge. A case study involving two classes, the Experimental and Baseline classes was carried out for 16-year-old Malaysian secondary school students. The students' nature of understanding in the baseline class who followed the normal classroom learning was compared with those in the experimental class who followed the designed worked example. Using the chi-square test of independence, the evaluation of students' responses in the post diagnostic test shows that there were significant differences in the experimental class students' performances in comparison to the baseline class students. The experimental class students demonstrated better conceptual scientific understanding regarding the roles of ions and electrons in the conductivity of the electrolytic cell in comparison to the baseline class. Thus, this designed worked example has a promising potential to be used as a tool in the Malaysian classroom for improving students' conceptual understanding of this topic.

Keywords: Designed teaching and learning, worked example, electrochemistry, electrolytic cell, learning demands, social constructivism.

THE USAGE OF WEB 2.0 APPLICATION AMONG TEACHERS

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The advancement of telecommunication tools such as broadband and WiFi as a medium to communicate gives the opportunity for the emergence of Web 2.0 applications. This web innovation transforms for more interactive of information technology services. Integrating of Web 2.0 applications in the education field gives a great potential to teachers and students in supporting and enhancing the quality of teaching and learning both inside and outside the classroom. Hence, this study was undertaken to identify the usage of web 2.0 application and the facilities of telecommunication equipment owned by them. A total of 64 teachers in secondary schools are used as respondents. Then, the data were analyzed descriptively (percentages). The finding shows, teachers were very familiar with the browser tools for information searching and social networking application, each recorded as the highest frequently application used. Nevertheless, there are still many other Web 2.0 applications that are less explored by the teachers. Based on this study and the findings, teachers will be able to improve their professional level if they can use these applications wisely as a resource for teaching and develop students skills in term of technology used as materials for learning.

Keywords: application; teaching and learning; teacher; technology; Web 2.0

CLONING OF METEROXYLON SAGU CYSTEINE PROTEASE (MSCPR)

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Protease is a group of enzymes that degrades polypeptides. Cysteine protease usually can be found in the animal, plant kingdoms and also in viruses and bacteria. It has many roles in plant cell physiology and development such as in embryogenesis, tracheary element differentiation, germination of seeds, leaf and flower senescence, and also in response to biotic and abiotic stresses. Cysteine protease was previously found to be present in sago palm via expressed sequence tags analysis of young sago palm leaf. In this project, the aim is to clone Metroxylon sago cysteine protease (msCPR) cDNA into a bacterial expression vector, pET41a+ (Novagen). The cloning will be done via Polymerase Chain Reaction (PCR) method, followed by verification analyses such as using restriction enzyme and sequencing of the PCR product. The putative cDNA will be further analysed in a bacterial expression system using Rosetta cells (*E.coli*) for determination of function.

Keywords: Cysteine protease, Complementary DNA (cDNA), Polymerase Chain Reaction (PCR), stress

BRACING TO MEET THE CHALLENGES OF EDUCATION THROUGH THE IMPLEMENTATION OF ICT EDUCATION INITIATIVES IN DEVELOPING NATIONS.

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This study investigated the relationship between students' performance in linearly combined science subjects on their performance in computer studies. The design of the study was survey. The population is all the senior secondary class 2 students in Port Harcourt metropolis. The sample size was 74 SSC2 students participated in the study. Random sampling technique was used to select 74 students from 23 private and 14 public schools in the area. A total of 47 students from the private schools and 27 students from the public schools participated in the study. The instrument for data collection was a 100-item multiple choice test (quiz) in five science subjects. The result shows that R-value of 0.545 shows a strong influence of linear construct (mathematics, biology, chemistry and physics) on the performance of students in computer studies. The r^2 -value of 0.297 indicates roughly the contribution of 29.7% to computer studies of the independent variables. The students' performance in the linear construct (four subjects) has a significant influence on their performance in computer studies ($F_{1, 72}=30.431$, $p<.05$).some recommendations were made.

LEARNING PROBABILITY IN ART STREAM CLASSES: DO COLOUR BALLS WITH STAD-COOPERATIVE LEARNING HELP IN IMPROVING STUDENT'S PERFORMANCE?

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Many of the ideas behind „probability“ are difficult to learn and therefore hard to teach (Ahlgren & Garfield, 1991). This study addressed such concern by investigating the effects of Colour Balls with Student Teams-Achievement Division (STAD) cooperative learning (CBCL) method on Form Four students' performance in learning probability; and also to explore students' insights and experiences of their learning in CBCL method. The sample consisted of 160 Form Four Art Stream students who were randomly selected from two secondary schools in the District of Tambunan, Sabah, Malaysia. Quasi experimental pre test post test control group design was employed in this study. The experiment group was exposed to the CBCL method while the control group was merely exposed to the STAD cooperative learning (CL) method. Three instruments were used namely Probability Performance Pre-test, Probability Performance Post-test and group interview to collect data. The quantitative data collected in this study were analysed using Independent and Paired-samples T-test at $\alpha = 0.05$ level of significance. The findings revealed that students taught with CBCL method performed significantly higher than the students who were taught with CL method. In addition, the data gathered through group interview showed that students had positive perception towards the use of CBCL method in learning probability. These findings suggest that mathematics educators could use Colour Balls with STAD cooperative learning method to improve Art Stream students' performance in the topic of probability.

FIRST RECORD OF MARINE DINOFLAGELLATE, ALEXANDRIUM TAMUTUM (DINOPHYCEAE) FROM MALAYSIAN WATERS

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Several species of dinoflagellates in the genus *Alexandrium* are known to be toxic and have been associated with paralytic shellfish poisoning (PSP) in Malaysian waters. These *Alexandrium* species showed high morphological similarity among the toxic and non-toxic species, and details observation of thecal plate's arrangement is required for precise species identification. Co-occurrence of toxic and non-toxic species complicated the plankton monitoring of PSP. In this study, a clone of *Alexandrium* was established from samples collected from Kota Belud, Sabah. The specimen was observed under epi-fluorescence microscopy and genetics data on the nuclear-encoded ribosomal RNA genes were obtained from clonal culture. Morphologically, this clone showed relatively wide and large sixth precingular plate (6') compared to that of *A. minutum*. The sulcal posterior plate (Sp) of the clone is similar to that of *A. minutum* which is wider than long, but is longer than wide than that of *A. tamarensis*. The first apical plate (1') is irregularly rhomboidal with a small ventral pore (Vp) present on its right margin. All morphological characters resembled to the species description of *A. tamutum*. Phylogenetic analysis of the ITS rDNA region also revealed monophyly of this clone with other *A. tamutum* strains, and separating them from the *A. minutum* clade. Species-specific sequence signatures of *A. tamutum* were obtained in silico, which could be as potential oligonucleotide probe regions for species detection by molecular tools. This represents the first report of *A. tamutum* from Malaysian waters.

Keywords: *Alexandrium tamutum*, Sabah, Malaysia, thecal plates

LIVE SCIENCE AND LOVE LEARNING THROUGH ETHNOSCIENCE: A CASE AGAINST COGNITIVE RE-WIRING

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In spite of empirical evidence that the acquisition of scientific concepts and skills depend on a prior notion of the objects, events and their relationships, adherents of western science still impose the unified scientific method on learners from diverse culture and environments/influences. This paper exposed the risk and adverse effects of cognitive rewiring in learners. A case for ethnoscience is a case against the academic ideology of cosmopolitan brotherhood in science.

CURRICULUM, POLICY & ASSESSMENT

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University students' performances are evaluated in most part of the world by the use of an assessment instrument popularly referred to as Cumulative Grade Point Average (CGPA); whereas, at lower levels (Primary & Secondary schools), Cumulative Average Mark/Score (CAM/S) is employed as the instrument of evaluation. This paper examines other assessment instruments along with these two instruments and makes comparison between CAM/S & CGPA in order to establish the preference for CGPA for tertiary educations. The uniqueness of this paper is the development of a mathematical relationship between the marks/scores earned by students and the grade points assigned to these marks/scores which are used to calculate the required CGPA.

SECONDARY SCHOOL STEM EDUCATION: WHAT DOES THAT LOOK LIKE?

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I approach this discussion as a technology educator, and the place of Technology in a STEM approach to the curriculum is fraught. At the tertiary education level, it is not clear what technology is while science, engineering and mathematics are all well identified. At the secondary education level, it is not always clear what engineering is, science and mathematics are clearly defined and generally compulsory, while technology may be an elective area of study, which is often confused with information technology. So the role of the 'T' in STEM is not clear, but as I shall indicate in this discussion, neither is the relationship between all of the subjects.

Proposals for Science, Technology, Engineering and Mathematics to be presented in the secondary curriculum in an integrated way have been developed in some countries for at least three decades now, but are recently becoming more common and more significant. Some proposals are now being delivered with high level political clout, for example the US Hatch#9 Proposed Amendment “which will help prepare current and future U.S. students for the best, high-paying jobs of the 21st Century in the science, technology, engineering, and math (STEM) fields” (STEM Education Coalition, 2013), and the UK appointment of a National STEM Director followed by a range of similar initiatives to promote the STEM agenda. In other countries this grouping of subjects is promoted as a coalition at a range of levels and for a range of purposes.

The rationales indicate the motivation for STEM proposals: shifts in workforce patterns and downward trends in economic indicators. It is not uncommon for curricular development in Technology Education to be promoted in periods of economic downturn. Using Australia as an example, there is a clear correlation between the economic depressions of the 1890's, 1930's and 1980's and significant developments in technology education (Williams, 1996). It is not implausible that the recent global financial crisis is a stimulant to calls for the STEM education agenda.

The agenda for this amalgamation is being driven by vocational and economic goals. Vocational goals relate to skills shortages in science and engineering areas, “studying STEM creates a pathway to a brighter future, opening up a wide range of interesting and exciting career opportunities” (Central Office of Information, 2008). STEM strategies are designed to develop a strong supply of scientists, engineers, technologists and mathematicians (Department for Education and Skills, 2006), and the UK government has serious concerns about how vacancies in these employment sectors are to be filled in the future (Barlex, 2007). And in the USA, “a growing number of jobs require STEM skills and America needs a world class STEM workforce to address the grand challenges of the

21st century, such as developing clean sources of energy that reduce our dependence on foreign oil and discovering cures for diseases” (The White House, 2009).

The economic argument for emphasis on a STEM alignment follows this vocational rationale. The US argument goes that a focus on STEM will result in “reaffirming and strengthening America’s role as the world’s engine of scientific discovery and technological innovation which is essential to meeting the challenges of this century” (Obama, 2009). And similarly in the UK, “as the UK seeks to position itself against global competitors at a time of rapid economic change, the priority of increasing its capacity for innovation and enterprise becomes increasingly urgent” (STEM Programme, nd), a goal which is seen can be achieved through the promotion and national coordination of STEM activities.

PROSPECTIVE ELEMENTARY TEACHERS' KNOWLEDGE OF DISSOLVING: A VYGOTSKIAN THEORY OF CONCEPT DEVELOPMENT PERSPECTIVE

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This study reports on the use of concept maps as an assessment tool to investigate elementary pre-service teachers' knowledge about dissolving. Propositions from pre/post concept maps were scored using the total proposition accuracy scoring technique (TPA) and were also used to classify concepts as scientific or spontaneous using Vygotsky's theory of concept development. Vygotsky (1986) described spontaneous concepts as un-unified and employing concrete, and factual groupings, while scientific concepts are organized hierarchically and have a system. After the instructional intervention, statistically significant improvement was shown on a paired sample t-test ($t = -4.154, p < .001$) and many spontaneous concepts which appeared on the pre-concept maps, were either reduced or eliminated. Although medium statistically significant gains were noted for the t-test, these findings suggest that the elementary pre-service teachers' science content knowledge about dissolving is weak as the average TPA score was less than two accurate propositions ($n=49$) and many teachers continued to hold the same misconceptions as reported for K-12 students in previous studies. Recommendations include: adding a non-majors chemistry course, focusing on the particulate nature of matter during methods course work, and using screening practices to eliminate pre-service teachers who display weak science knowledge.

MANIPULATION OF GROWTH HORMONE (GH) GENE IN TOR TAMBROIDES

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The Mahseers (*Tor* spp.) are highly valued freshwater fishes across the Himalayan and South-east Asian regions. *Tor tambroides* is the most valuable and highly priced among all cyprinid fish in Malaysia and locally known as empurau. However, *T. tambroides* has a very slow growth rate which the weight is accelerate approximately 500g to 600g per year. Besides, the growth hormone gene data for *T. tambroides* is very limited. In vertebrate, the growth rate is controlled by growth hormone. Growth hormone in *T. tambroides* is also known as somatotropin and it is made by 210 amino acids. Somatotropin plays a major role in coordinating the growth, energy mobilization, gonadal development, appetite and social behaviour in vertebrates. The existence of growth hormone gene will be checked by designing suitable primers which the template growth hormone gene will be retrieved from GeneBank. The gene obtained will be cloned into pGEM-T vector and the expression of the somatotropin will be analyzed by in situ hybridization technique. The unknown upstream region containing the promoter will be sequenced, identified and analyzed by using genome walking method. The full length sequence of the somatotropin will then be generated and injected into *T. tambroides* embryos. It is expected that the growth of the embryos of *T. tambroides* will be improved after injection.

Keywords: *Tor tambroides*, somatotropin, in situ hybridization, genome walking.

ISOLATION OF OLEAGINOUS FUNGI FROM VARIOUS AGRICULTURAL SOURCES IN SARAWAK

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The purpose of this project was to isolate and identify oleaginous fungi from various agricultural sources, such as sago effluent, fruit surfaces and sugar cane juices. Samplings were carried out using enrichment medium and Rose Bengal Dichloran Chloramphenicol Agar. Upon inspection of their morphologies and sizes, the selected yeasts were then observed under light microscope. Sudan IV was then used to determine the lipid accumulation abilities in the fungi cells. In addition, Polymerase Chain Reaction was performed on the oleaginous fungi isolates, targeting the D1/D2 region of 26S rDNA. The PCR fragments were then sequenced to establish their identities. The resultant sequences were compared with those available on the NCBI website database through the BlastN algorithm. From the BlastN analyses, *Kluyveromyces marxianus*, *Pichia manshurica*, *Candida tropicalis* and *Candida krusei* were identified from the overall cultures. Keywords: Oleaginous fungi, Rose Bengal Dichloran Chloramphenicol Agar (RBDC), Polymerase

WORLD SCIENCE PROJECT – THE SQUARE KILOMETRE ARRAY

Peter Quinn

Mankind's understanding of Nature is now at a point of crisis. More than 95% of the Universe we live in is composed of mysterious stuff - matter that is hidden from the view of our telescopes and a form of energy that is tearing the Universe apart. Our two most successful theories of Nature - the theory of atoms and the theory of Gravity - cannot together describe the Big Bang which formed the Universe 13.7 billion year ago. We need a new idea, a new concept that will provide us with a consistent picture of the evolution of our Universe and its contents. New ideas flow from discoveries. Our ability to explore, and map and make discoveries within our Universe is about to be exploded by more than a factor of 10,000. The Square Kilometre Array (SKA) radio telescope will revolutionize our view of the Universe. It will push the boundaries of our knowledge back in time to the formation of the first stars and galaxies. It will also push the boundaries of our technology and will provide new industrial, educational, scientific and technological opportunities in the 21st century.

VYGOTSKIAN APPROACH TO TEACH CHEMISTRY: ANALOGY AN WAY, ECONOMIC AND VIABLE SOLUTION TO QUALITY IMPROVEMENT.

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After working for more than two decades in high schools I am still concerned about the practices in rural classrooms and the performances of my rural students. In my opinion everyone in the field of science education should be worried about the outcome of the science teaching at high school levels. We are observing lesser participation of youths in the field of science and technology. Not many high school graduates are able to take part in the field of science and technology after they are graduating from high school system. A study by Ruthven¹ indicated the lack of effectiveness of giving notes and copying in the teaching learning process. They suggested that student centred approach is the best way towards an effective teaching learning process. Let us compare this study of Ruthven¹ with the situation of local rural schools. Almost all classes are extra large (more than 50 students are present in almost every class). Other than the chalkboard and prescribed text book there are almost no effective resources available for the teachers. Teachers are busy writing old questions and their answers for their students

RESEARCH ON EDUCATION PLANNING OF SCIENTIFIC AND TECHNOLOGICAL PROBLEM OF CHINA'S PUBLIC SECURITY

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In the past development phases governments at all levels attached great importance to commonweal issues such as public security by formulating various industrial standards and relevant laws and policies. Many advanced technologies and products were also applied in the field of public security, which played a positive role in the science scientification, automation and informationization of the public security. Despite all of this, public security has never been substantially improved, and to some extent has impeded the development of the economy and of society at large. The historical experience and theoretical research on social development have shown that the development of modern society is mainly reflected in the effective synergy of the three major factors - economy, science and technology in addition to management. Advancing the economic means and management methods parallel with the advances in science and technology will become the development trend over the next two decades. In particular, in planning the mid-and- long term scientific and technological education planning of a country or various regions, the scientific and technological issues concerning public security are taken out as a special topic for research,, thus demonstrating their significance to the research. However, these researches all ignored a crucial problem, i.e., the relationship between public security operation system and scientific and technological education research. This paper, based on the research of Refs [1-6], will conduct research on issues relating to public security science and technology from the perspective of education planning.

EXPLAINING AND PREDICTING ENVIRONMENTAL ATTITUDE AMONG THAI HIGH SCHOOL STUDENTS BY SELECTED BASIC HUMAN VALUES AND ENVIRONMENTAL KNOWLEDGE

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The study is a correlational research. A multiple regression model was built using a step-wise procedure to determine level of importance of two basic human values; self-transcendence and openness to change, and environmental knowledge upon environmental attitude. A total of 1012 high school students were randomly selected through multi-stage sampling from 8 secondary schools in Bangkok Metropolitan Region, Thailand. Standardized psychological instruments were used for collection of data. Descriptive, correlation, and linear regression methods were used to describe the relationships between variables in the hypothetical model. This study found that students' environmental attitude was related to the basic values but not to their environmental knowledge. There was a positive significant coefficient for self-transcendence ($b_1 = .28$) and openness to change ($b_2 = .12$), suggesting that students with high degree of these values tend to have more positive environmental attitudes. However, the explanatory power of the model was low, with 12% of the variance explained for environmental attitude. Implication of the study for cultivating desirable values and promoting positive environmental attitude to students were discussed.

ACTIVE LEARNING BY INVOLVEMENT IN CLASSROOM

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The paper discusses about the effect of strengthened student involvement in a classroom on their learning at a tertiary institution. With the development of web-based learning and teaching technologies, such as i-Lecture, Blackboard, WebCT and similar other software, lectures have become more flexible than before. With the utilisation of the available software, lectures can be recorded in audio and video modes and made available to students through internet. Students can have access to the recorded lectures through internet and watch any time and as many times as required. This is very useful for students to revise lectures at home and catch up with the missed lectures. However, the on line availability of lectures may affect student attendance in face to face lectures. This is because students may sometimes excessively depend on the recorded lectures that they are able to watch at any time. Remaining absence from lectures results in missing the face to face interaction of students with the lecturer and with their peers. As a consequence, students miss the opportunity of deep and meaningful learning that occurs in the classroom interaction and engagement. Thus, absence from face to face lectures and excessive dependence on the recorded lectures may result in more surface learning than deep learning. Evidence show that involvement of students in various activities in the face to face lectures usually improves the learning experience and thus encourages students to attend in lectures. The effect of strengthened student involvement in classrooms on their learning in an engineering unit at a University is discussed in this paper. Direct involvement of students in solving of problems was increased in the classroom activities in one part (part “A”) of a unit. The effect of more student involvement on their learning was evaluated by looking at the attendance and their performance in the end of semester examination. It was observed that student attendance improved and more students attempted questions of part “A” than the other parts of the examination paper. When performances in different parts of the unit were compared, it was found that lectures with strengthened student involvement improved their confidence on the topics. Thus, increased involvement or engagement of students in the classroom helped achieve deeper learning. Therefore, incorporation of more student involvement can help maintain high student attendance in classrooms when web-based lectures are also available for students to access at any time. The benefits of these web-based lecture systems can thus be maximised to promote deeper learning by involving students more in the classroom activities.

SCIENCE AND TECHNOLOGY EDUCATION INITIATIVES IN NIGERIA: THE CASE OF STEP-B

Prof Michael Adikwu

Abstract

Over the years, many countries have thought of how to create wealth, increase youth employment, increase quality of life in various frontiers. To do this, many low income countries, have depended on international development partners, such as the World Bank to help in assuaging the monetary needs of these nations.

On a global scale, there are lots of stressors that are confronting nations. There are floods, diseases, terrorism, earthquakes and avalanche of other stressors that distort the budgets of nations. The ability and capacity to readjust is often absent in many developing countries in Africa and such, these nations will depend more increasingly on donor agencies and countries.

Apart from prebendalism and other forms of corruption, funds from donor nations can catapult poor nations to the glory in development which they crave for. A good example is the Science and Technology Education Post-Basic Project (STEP-B), Nigeria. This project improved the educational sector in Nigeria raising both the intake and quality of students studying science courses at all levels of the education ladder in Nigeria. The results from this project are presented in this chapter as well as the focus of future projects in the education sector.

DIFFICULTIES EXPERIENCED IN THE LEARNING OF ELECTROCHEMISTRY CONCEPTS BY STUDENTS OF DIFFERENT COGNITIVE STYLES

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In Nigeria, students' achievement in Senior School Chemistry Examinations has been poor over the years. A number of difficult Chemistry concepts have been identified as some of the major causes of students' poor achievement. Electrochemistry is one of such difficult concepts. This study was aimed to empirically identify the actual aspects of electrochemistry which students find difficult; compare the areas of difficulty experienced by students of different cognitive styles and suggest ways to improve students' achievement. Three research questions and one hypothesis guided the study. A sample of 400

SSII (grade eleven) students from four secondary schools participated in the study. Using Group Embedded Figure Test, the respondents were categorized into two cognitive styles (Field Dependent group had 266 students while Field Independent group had 134). After exhaustively teaching electrochemistry concepts for six weeks by expert trained teachers, the respondents were administered with Electrochemistry Diagnostic Test. It was found that six broad areas of concepts posed considerable difficulties to majority of students. Significantly higher proportion of Field Dependent students indicated more difficulties in learning electrochemistry than Field Independent students. It was suggested that Chemistry teachers should ensure adequate students' entry behavior on concepts leading to and involved in electrochemistry while emphasizing the areas of difficulties during teaching

THE GAPS BETWEEN TEACHERS' CLASSROOM PRACTICES AND BIOLOGY EDUCATION RESEARCH FINDINGS IN NIGERIA: NEED FOR INTEGRATION

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In Nigeria students' achievement in Biology has been poor over the years. Consequently Biology education researchers have been trying to discover innovative ways of teaching Biology to improve students' achievement. Although many innovative teaching methods/strategies have been discovered through research, students' achievement has not improved. This study was aimed to find out whether Nigerian Biology teachers adopt innovative teaching methods/strategies discovered by research. A sample of 153 Biology teachers at a national workshop participated in the study. The instrument for data collection was a questionnaire whose reliability was 0.82. Data were analyzed using mean, t-test, percentage and frequency count. It was found that Nigerian Biology teachers often use lecture/expository, project and discussion methods rather than effective innovative methods/strategies discovered in research. Although the teachers are generally aware of the innovative teaching methods/strategies, they fail to adopt them because of constraints: lack of pedagogic skills to use them, they are expensive, time consuming, extra-large classes, curriculum overload etc. It was suggested among others that science teacher education institutions should ensure that teachers in training should acquire knowledge and skills to use innovative methods while schools should provide needed resources. There is need for Biology teacher capacity building to bridge the gap between research findings and classroom practices.

SENIOR SECONDARY SCHOOL STUDENTS' IMPROVISATION OF ECOLOGICAL INSTRUCTIONAL MATERIALS: IMPLICATION FOR SUSTAINABLE SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS EDUCATION

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In recognition of the importance of Science, Technology, Engineering and Mathematics (STEM) to the social, economical, and political development of a nation, educators are concerned on the methods by which learners can be helped to have broader understanding. One of the ways by which this can be achieved is through inquiry based science classrooms. Hence, this study was designed to investigate the effect of the students' and teachers' improvised instructional materials on the academic achievement of students in biology. One research question and one hypothesis guided the study. A non-equivalent pretest – posttest quasi-experimental design was employed. The sample for the study consists of 109 Senior Secondary School one (SS1) students, randomly drawn from three senior secondary schools in Osogbo educational zone of Osun state, Nigeria into 2 experimental groups and 1 control group. A validated Ecology Achievement Test (EAT) with a reliability index of 0.65 was used for data collection. Mean and standard deviation were used to answer the Research question while Analysis of Covariance (ANCOVA) and Schaffer test was used to test the null hypothesis at ($P < 0.05$). The result showed that the use of students' improvised instructional materials led to the highest achievement scores out of the 3 groups.

CREATIVE SCIENCE, ITS BENEFIT AND STRATEGIES NEEDED FOR TEACHING IT IN RURAL AREAS OF AFRICA

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Nigeria is blessed with enormous human resources, unfortunately though Creative Science is yet to take its rightful place in the promotion of science and technological breakthroughs. This article looks at Creative Science in rural areas of Africa. It presents some of its benefits as: increasing knowledge and understanding of science and technology, developing essential practical skills as well as developing skills sought by industry, adding depth to the curriculum, through a structured, coherent problem-solving process, incorporating the process outcomes of Science and Technology curricula into the teaching program, linking the school curriculum to industry and the community. And outlined problems militating against creative science in Nigeria, which are grossly characterized by inadequacy of teachers, overloaded content, ineffective methodology by teachers, paucity of facilities, equipment and materials in laboratories, as well as socio-cultural lapses. Solutions such as: African governments should increase their support for research activities in public sector education or research institutes to accomplish: research that will determine the existence, nature and status of creative science in the rural areas and also the extent of cultural diversity in rural societies. Research that will lead to the development and implementation of tailor-made curricula that will address the skills shortage in creative science, research that will first address the question of research methodologies that are appropriate for teaching creative science; It then present numerous strategies of teaching creative science which includes: Encouraging collaboration with other researchers and leading students to a sub-field that is exciting, and maneuver them through an unexpected set of findings. Guide students to unleash the hidden genius in them and in their specialty, understand how science fiction prototypes and other creative endeavors can influence future innovations. Students should also be made to learn from leading scientists and engineers about current work being done in a variety of fields and how they might impact our future.

Key words: Creativity, militating, logic, genius, zeitgeist

EMBEDDING SPECIAL AND GENERAL RELATIVITY IN THE CURRICULUM FOR EXCELLENCE IN SCOTLAND

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The past few years have witnessed a major new development in Scottish Education with the introduction of the “Curriculum for Excellence”. It aims to achieve a transformation in education in Scotland by providing a coherent, more flexible and enriched curriculum for students aged 3 to 18 – thus ensuring that Scotland’s children and young people are equipped with the knowledge, skills and attributes needed for life in the 21st century. In the Sciences the introduction of Curriculum for Excellence has created an important opportunity: to place a much greater emphasis on the process of science – focusing not so much on what we know, but how we know it. In particular the science curriculum has been revamped and reshaped to introduce topics that are at the cutting edge of present-day research, using these topics as a vehicle for exploring research methodology, promoting open-ended enquiry and building problem solving skills. In Physics the revised curriculum for secondary pupils now features a significant astrophysics component that includes an introduction to special and general relativity. In addition a new “Researching Physics” module – in which pupils spend up to 20 hours researching a cutting-edge research topic such as exoplanet detection or the search for gravitational waves – has been piloted in a number of secondary schools. In this talk I will present an overview of the impact of the Curriculum for Excellence on physics teaching in Scotland. As a member of the Qualifications Design Team that is overseeing the Curriculum’s introduction, I will discuss the revised content and structure of the physics syllabus with particular focus on the elements of special and general relativity and the “Researching Physics” module. I will describe some of the key advantages and challenges in presenting relativistic concepts within the new curriculum, and highlight the important role for Scottish University Physics Departments in providing expert advice, equipment and support materials for teachers and pupils.

USING A CONSTRUCTIVIST LEARNING ENVIRONMENT TO MINIMIZE GENDER DIFFERENCES IN A RURAL BASIC SCIENCE CLASSROOM IN NIGERIA

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This study on the use of an activity-based constructivist learning environment to minimize gender differences in a rural basic science classroom in Nigeria was carried out in Ugbokpa, a rural community in Mosogar town, Ethiope west Local government area of Delta State Nigeria. The purpose of the study was to find out if male students taught basic science in an activity-based constructivist learning environment would perform equally as females taught in the same environment. It was also to find out if males taught in a conventional lecture-based learning environment would perform equally as females in the same environment. Two hypotheses were raised. Using t-test statistical analysis on the post-test scores of students from a test of basic science on topics they were taught for an eight-week period results showed significant differences in gender in the conventional lecture environment which was also the control group but no significant gender difference was found in the activity-based constructivist group. This shows that the constructivist environment can help to reduce gender differences. It was therefore recommended that the activity-based constructivist learning environment should be created by science teachers in Nigeria especially in rural areas where students are more prone to gender biases.

WHY DO WHALES BEACH THEMSELVES: SCIENTIFIC INQUIRY USING ICT

Rachel Sheffield

Abstract

The review and development of a new Bachelor of Education degree provided the opportunity and impetus to create a unique first year science inquiry unit. It was imperative to identify the key drivers that would ensure that this unit not only conformed to University requirements but also embraced current education policy and thinking. Informing the development of this new unit were the Australian Curriculum and National Professional Standards for Teachers, and a Federal Government initiative, Teaching Teachers for the Future (TTF) which had as its key focus use of the TPACK (technological, pedagogical content knowledge) Model. Embedded ICT technology tools were used to develop a foundation of essential science inquiry skills. 2

USING TRAVEL GAME BOARD IN SCIENCE TO ADD VALUE AND FUN IN LESSONS

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Teaching aid is one among many teaching media. Teaching aids are movable, reassemble and playable. It is an alternative learning agent because of their playable and movable nature. One of the teaching aids is the use of Board Games which are used in most key school curriculum learning areas and used mostly for drill and practice purposes and are usually played in small groups. This is a workshop which introduces the use of travel game board on selected lessons in Science. Travel game boards were made on topics in Science and can be adapted in other subject areas. A school try out has been conducted to find out the effectiveness of these materials. It has been observed that students able to learn some techniques in remembering and developing the concepts at the same time enjoy playing the game board.

**LEARNING WITH FUN
THROUGH
SCIENCE AND MATHEMATICS THINKER MOTIVATORS
(SMTM)**

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This is a workshop/demonstration of selected Science and Mathematics concepts with simple activities using simple and readily available materials as strategies to enhance learning and get more interested with the subject/s in varied levels of learners. It features the Higher Order Thinking Skills (HOTS) to Higher Order Learning Tasks Skills(HOLTS), multi-modal approach, applications, connections and strategy in the learning process using the Science and Mathematics Thinker Motivators (SMTM). The SMTM therefore are excellent materials in the curriculum enrichment for the basic education to enhance and expand the learning process. It can be used as motivator before the lesson proper to stir up the class, provides the student as an activity in order to maximize the contact time; can be used as an assignment/homework; can be used as an enrichment activity which can be done inside the classroom, at home or any fun activities.

RELATIONSHIPS BETWEEN CITED INFLUENCES IN CREATIVE PRACTICE IN SCIENCE-RICH CONTEXTS AND UNDERSTANDING OF CREATIVITY.

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Creativity has been argued as integral to our education futures from opposing paradigmatic perspectives. It is therefore crucial that we support practitioners in developing understanding of the implications these positions present. Although traditionally not recognised as a creative subject within early childhood education and care, science holds great potential as a rich context for children to develop their creative potentials as they engage in and make sense of their world. This paper reports on a study involving three early years practitioners who examine the relationship between their cited influences in creative practice in science-rich contexts and their understanding of creativity. The use of Video Stimulated Reflective Dialogue was found to empower practitioners by supporting them to make explicit, unconscious tacit structures shaping their practice. Findings also revealed dominant epistemological positions on the nature of creativity, conceptions of creativity as synonymous with the arts and stark contradictions between espoused theory and theories in use.

TAXONOMY AND ETHNOPHARMACOLOGY OF INDIGENOUS MEDICINAL PLANTS IN ILOILO, PHILIPPINES

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This study aimed to (1) categorize the diversity of medicinal plants in Tigbauan, Iloilo, Philippines based on their taxonomic rank; (2) document the traditional uses, preparations and applications of medicinal plants (ethnopharmacology) by the local community; (3) determine the distribution, morphological forms, habitat and values of indigenous medicinal plant resources in Tigbauan, Iloilo; and lastly identify and enumerate the medicinal uses of each identified indigenous plants. Ethnopharmacological and taxonomic data of indigenous medicinal plants were collected in the study site through semi-structured interview and snowball sampling methods among knowledgeable elders, gardeners, healers, and traders. The taxonomic classification of the indigenous medicinal plants in Tigbauan, Iloilo was based on Cronquist's System of classification. A total of 101 species, grouped within 92 genera, 44 families and 27 orders. The medicinal plants were described according to preparation techniques, mode of application, administration route, growth forms, habitat distribution, abundance and medicinal uses. Results showed a diversity of medicinal plants, traditional and ethnopharmacological knowledge about the uses, preparations and applications present and maintained among the Tigbauenos. This study allowed the identification of many high value and high priority medicinal plant species, indicating high potential for economic development through sustainable collection and trade

EFFECTIVENESS OF THE USE OF E-LEARNING PORTAL AND E-BOOK OF BIOMIND MODULE IN OVERCOMING STUDENTS' MISCONCEPTIONS

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Instructional media is an important component in the process of teaching and learning. Which using the medium of instruction than expected to overcome misconceptions students on what they have learned. At present conceptual knowledge is important in the face of the new millennium. This research is carried out to see the effectiveness of various BIOMIND modules integrated with the concept of PBL in the process of teaching and learning Science in order to overcome students' misconceptions. A total of 182 students of SMAN 8 Pekanbaru, Riau, Indonesia participated in this study. This research is to develop an e-learning portal and e-book of BIOMIND modules. This research used quasi-experimental methods to design "non-equivalent control group design", which involved two treatment groups and one control group. The first treatment group used an e-learning portal of BIOMIND modules, whereas the second treatment group used the e-book of BIOMIND modules. Then control groups went through the teaching and learning process using conventional method. The instruments used were the misconceptions test. Analysis of the findings was done descriptive analysis followed by inference analysis using ANOVA

**WOMEN'S PARTICIPATION TOWARDS SUSTAINABILITY AT
SUNDERBANS DELTA, INDIA – A PILOT STUDY**

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Environmental degradation works like slow-poisoning, who they are not directly affect- ed by the harsh environmental hazards can't feel for the nature.

RELATIONSHIP BETWEEN FACTORS OF STUDENTS ADJUSTMENT AND PER- FORMANCE IN SCIENCE

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Perry et al. (2001) discussed that after the completion of 12 years of education in schools and colleges, and then transition to university can be a stressful experience for many undergraduate students and they are often confronted with a variety of new personal and interpersonal challenges which creates problems for their adjustment at university level.

Whereas, Abdullah et al. (2009) have t to be very appealing experience for students which can give satisfaction to students. University adjustment is a multidimensional concept which includes students' academic demands, being socially integrated with other students, faculty, and personnel in the university, being involved in campus activities, maintenance of one's own psychological and physical well-being, and being attached and committed to the university (Baker & Siryk, 1984a). Academic adjustment refers the students' success in dealing with the various educational demands of the university experience (Tuna, 2003). It is displayed by positive attitudes towards academic goals and academic work, by motivation to learn, and by a sense of satisfaction with the academic environment (Baker & Siryk, 1999). Tuna (2003) discussed that social and environmental factors are some influential factors which contribute towards students' academic adjustment. Experts in the area of higher education recognized that student' academic adjustment and success in higher education institutions requires willingness and their ability to meet the academic as well as social challenges. Students who completed their higher education are able to create a bright and successful future, and thus support the nation's vision to attain a developed country status. Pfeiffer (2001) discussed that students of higher education especially in science disciplines all over the world are experiencing high demands and expectations that have been placed upon them. Nelson, Dell'Oliver, Koch, & Buckler (2001) have the opinion that these demands of the society, parents and teachers to perform well in their studies created stress on students and the students who are unable to cope with the pressures of studying are often more likely to experience mental, emotional, physical and psychological problems.

Results of the study conducted by Abdullah et al. (2009) revealed that in their early life at university, students' academic achievement was found to be significantly predicted by students overall adjustment in university, academic adjustment, and personal emotional adjustment. Boute et al. (2007) conducted a study to explore the importance of friend- ship and adjustment among first year university students in six

Canadian universities and found a significant positive relation between quality of new friendship and adjustment to university which ultimately improve their performance and learning in undergraduate programs.

Results of the study conducted by Lubben, Davidowitz, Buffler, Allie, & Scott (2010) to explore the factors influencing access students' persistence in an undergraduate science programs in South African perspective reveal that support for academic and emotional adjustment is seen as successful by students, and that such support may be used to remove barriers to students' career aspirations which ultimately encourage them to perform well as lifelong learners. Similarly, data also suggest five reasons for students discontinuing their undergraduate studies which include: academic workload, perceived relevance to first-choice career aspirations, financial difficulties, family issues, and attitudes to being part of an access program. Keeping in view this discussion, this research study aimed to explore relationship between factors of university adjustment and performance of students at undergraduate level.

E-SCAPE

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The E-scape is our school gateway to the great outdoors. This online platform links our students to a range of voluntary citizen science projects - from Astronomy to zoology

- and to a range of environmental real life simulations. All have translated into improved learning opportunities across many curriculum areas. The projects primarily offer our students a chance to collaboratively gather and analyse real and meaningful data from within the school grounds and the surrounding Swan River precinct and with the guidance of the class teacher, parent experts or with the online support of a professional research network, become involved in observing the natural world or monitoring for natural resource management. Use of mobile devices, apps and the E-Scape links connect to data base portals for easy information collection. Our students have become proactive sustainability ambassadors for our local environment. All of our data collection is based on sound scientific methodology and is run according to accepted ethical standards while offering students a chance to get recognition for their acquired skills and environmental initiatives.

Delegates will be given access to the E-Scape and also be guided through our Year 5

Water-Scape activities (World Water Monitoring, Teach Wild, Creek Watch, Catchment Detox, Global Water Projects, Rivers of Emotion); work samples that clearly indicate the value added across Science, Technology, Maths, Geography, History and English; and the electronic profiles of students that recognise their skill acquisition and environmental achievements.

WHAT CAN THE SUCCESSFUL RESPONSE TO STRATOSPHERIC OZONE DEPLETION TEACH US ABOUT MANAGING CLIMATE CHANGE? A FOCUS ON HEALTH RISKS.

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On behalf of the United Nations Environment Program Environmental Effects Assessment Panel Sun exposure can cause skin cancer and eye diseases and may impair function of the immune system in humans. Most damage is caused by the shorter wavelength ultraviolet-B (UV-B) radiation. This UV-B radiation also damages plants and materials, has wide-ranging effects on aquatic ecosystems as well as influencing air quality and biogeochemical cycles. This component of solar UV radiation is largely filtered out by ozone in the stratosphere, so that UV-B comprises only a few percent of the total UV radiation reaching Earth's surface. Over the last half of the 20th century, stratospheric ozone was depleted due to the release of halocarbons – from aerosols, refrigerants, manufacturing of plastics – into the atmosphere. This man-made potential global environmental disaster that could have allowed high levels of damaging UV-B radiation to reach Earth's surface was avoided by rapid international cooperation in limiting and then phasing out the use of halocarbons. In the 21st century, we are faced with another potential global environmental disaster: climate change. Here the solutions are less clear-cut and economically more challenging.

ISOLATION AND CHARACTERIZATION OF PHENYLALANINE AMMONIA- LYASE GENE IN SAGO PALM

Saiful Shakirin Bin Rosli

Phenylalanine ammonia-lyase (EC 4.3.1.24) is an enzyme that is involved in several metabolic pathways such as in tyrosine metabolism, phenylalanine metabolism, nitrogen metabolism and phenylpropanoid biosynthesis. Through phenylpropanoid pathway, the deamination of phenylalanine to transcinnamic acid which is a precursor for the lignin and flavonoid biosynthetic pathways is catalyzed by phenylalanine ammonia-lyase enzyme. The production of phenylpropanoid products in plants indirectly can increase phenylalanine ammonia-lyase activity and its activity can be affected by the stage of development, differentiation of cell and tissue, and also during exposure to different stress stimuli. Besides, the expressions of phenylalanine ammonia-lyase gene also play an important role in plant defense. The presence of phenylalanine ammonia-lyase enzyme has been shown previously to be induced upon infection and the absence of this enzyme resulted in reduced phenolic compound production. Besides infection, mechanical wounding, UV irradiation, drought stress and drastic temperature changes in plants also can stimulate phenylalanine ammonia-lyase activity. Phenylalanine ammonia-lyase gene in gymnosperms phenylalanine ammonia-lyase activity. Phenylalanine ammonia-lyase gene in gymnosperms is more phylogenetically diverse compared to phenylalanine ammonia-lyase gene in angiosperms and the evolution of its function between gymnosperms and angiosperms are contrast with each other. The average cDNA size of phenylalanine ammonia-lyase gene is 705 amino acids and approximately 252 amino acids have been isolated. This project aims to isolate full sequence of phenylalanine ammonia-lyase gene in sago palm and characterize it.

PARENTS' INVOLVEMENT IN STUDENTS' MASTERY OF SCIENCE PROCESS SKILLS THROUGH INTERACTIVE HOMEWORK

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Science education, introduced at the primary school level, is aimed at nurturing the interest of young students in science and technology from an early age whilst at the same time developing their innovativeness and creativity thus providing them an avenue to apply science and technology in everyday life. Mastery of science process skills together with the appropriate knowledge and attitude will enable students to think more effectively. However, the limited time available during schooling hours for a thorough learning process in science have been identified as one of the factors that have prevented students from mastering the lessons delivered by the teacher. The transformation of the education system in Malaysia through the Pelan Induk Pembangunan Pendidikan 2013-2025 has provided room for a solution of this problem. 11 major thrusts for a transformation to the system have been identified. Amongst others, trust number 9 highlights an alternative approach to the education system currently in place by involving collaborations with parents, the community and the private sector with a view of helping students to enhance their scholastic achievements in school. Through this transformation, the learning system will be redefined as the process of learning will not only take place within the confines of the classroom but can also happen at home and in the community. In view that the nature of knowledge in science also rests upon the premise of human effort and endeavour in finding a rational explanation relating to events occurring in their everyday life, this paper proposes that the process of learning science process skills should not only occur in school but shall also directly involve parents at home through the proposed implementation of the interactive homework. The interactive homework shall be accompanied by an easy to use guidebook for the parents so that they can directly participate in their children's learning process while at the same time indirectly exposing the parents to the lessons that their children have learned in school. This will be an enabler to the parents so that they can assist their children in mastering thus increasing their achievement in science. It is hoped that this collaborative initiative involving the school and parents will help improve the mastery of science amongst students which will in turn contribute towards meeting the nation's requirement for highly skilled manpower in the 21st century.

Key words: Parents' involvement; science process skills; interactive homework.

TRANSNATIONAL PROFESSIONAL INDIAN WOMEN: A CASE STUDY OF MELBOURNE

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In the era of globalization, many women have opted for employment abroad to advance their career development. These immigrants are faced with a host of new challenges and new experiences, including differences in educational background, religion and culture between the place of origin and the place of work. The career progress of these professionals, (who will necessarily continually adapt), and how they influence bilateral relations between the two countries, are some of the issues have been addressed. The study has explored these aspects, focussing on women from India making their careers in Australia. The main objective was to explore the transnational cultural context of the Indian women professionals in Australia. The findings of such a study in cross - cultural settings, with a focus on women, will open up a viable knowledge resource base for human resource management and planning. It is also expected that the findings of this study, would help reform the existing immigration policy and emerging Diaspora trends. The study has explored and analysed the transnational global networks of social relations that link together the country of origin and country of employment. A “transnational social field” has been constructed to maintain familial, economic, political and cultural ties.

THE USE OF MOTHER TONGUE AS A MEANS OF COMMUNICATION IN THE ENHANCEMENT OF SCIENCE LEARNING IN PRIMARY SCHOOLS: THE NIGERIAN SITUATION

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The study is a multiple experimental study conducted in three classes (primary 3, 4, and 5), to assess the effect of mother tongue (Hausa) as a means of communication in the enhancement of science learning. Two research questions on the effect of mother tongue on learning and interest of the pupils to learn, guided the study. Two instruments: Achievement Test in Basic Science (ATBS) and Pupils Evaluation Guide (PEG) were used for the study. A total of 630 Basic Science pupils from three primary schools in Kano State, Nigeria participated in the study with 70 pupils each from primary 3, 4, and 5 from the 3 schools participated in the study. The three classes from each of the schools were differently subjected to an intervention, by teaching them science concepts in mother tongue and English language and were then evaluated to assess the effect of each intervention. Comparison of the scores from the two interventions was done using frequency and percentages. The cumulative result showed that in primary five 114 (54.2%) pupils out of 210 scored within the range of 70 and above when taught and assessed using the mother tongue but only 42 pupils (20%) scored 70 and above when taught and assessed using the English language. For the PEG, in every class during each intervention pupils were assessed based on 10 activities. The result showed that scores of 60 – 100% was obtained from the instruction using mother tongue, while 0 – 40% was obtained when the communication was done in the English language. Hence the result showed the use of mother tongue as a media of instruction can serve as a means of enhancing pupils' interest and achievement in science.

MOBILE LABS AND MOBILE LAB CLASSES

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With the main intention to engage students from primary and secondary schools in physics and to raise their interest in science, the Department of Physics at ETH Zurich runs a couple of mobile experimental laboratory projects. Similar to comparable initiatives, we have been building up a mobile collection of physics experiments that can be booked by schools. These elementary but spectacular experiments are all build by apprentices as part of their apprenticeship in mechanics, electronics or laboratory technology. Besides, we offer complete half-day courses on scanning tunneling microscopy (STM). STMs are rather expensive devices that schools usually cannot afford. By appointment a faculty member equipped with 6 mobile STMs visits the school. After a short presentation on electron tunneling effects, piezo motion and atomic structure, students are guided to operate the microscopes by themselves with different samples. In this presentation we report on the feedback of teachers and students we have received in the past four years. We discuss the benefits and the drawbacks of mobile labs and share our experiences with mobile lab classes.

IS POST-COMPULSORY SCIENCE A STUDY OPTION FOR EVERYONE? FINDINGS FROM AN INNOVATIVE SCIENCE PROGRAMME FOR YOUNG HUMANITARIAN IMMIGRANTS IN AUSTRALIA

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Science and technology in Australia are enriched by immigrants from culturally and linguistically diverse (CALD) backgrounds. While national policies recognise the innovation potential of these groups, mainstream informal education does not incorporate science and technology learning opportunities specific to CALD migrants. This is concerning because a significant proportion of the increasing number of humanitarian immigrants to Australia recently are of post-compulsory school-age. This paper describes an initiative trialled last year to introduce post-compulsory science and technology education and career opportunities to thirty young humanitarian immigrants from Africa and Asia. The initiative focussed on communicating science cross-culturally and featured activities at seven science and technology outreach centres which the participants visited over two-days. Formative evaluation revealed a positive change in the participants' attitudes about their access to post-compulsory education and careers in science and technology. Their feedback indicated that more informal learning opportunities are needed to inform CALD immigrants about participating in science and technology. Conversely, feedback from national programmes to acclimatise humanitarian immigrants stated that such opportunities are not consistent with the priorities for the settlement of new immigrants. This study concludes that elitist views towards post-compulsory science and technology education can restrict CALD immigrants achieving their innovation potential.

A SURVEY OF THE IDEAS OF JAPANESE STUDENTS ON SUSTAINABLE DEVELOPMENT

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The ESD movement has considerable influence in Japan. The national government has noted that as an outcome of ESD, it is expected that people can transform unconscious decision-making into concrete social action. ESD is also the key to reforming education and the value norms' (Cabinet Office of Japan, 2008). Further, 'ESD is the education that will help all people recognize that they live in a global world and that they have a relationship with future generations and with the environment' (Cabinet Secretariat of Japan, 2009). Consequently, ESD-based educational projects have been flourishing in universities and colleges (Dawe et al., 2005; Abe, 2007; Itoh et al., 2008; Nogami, 2010). However, while higher educational institutions have undertaken numerous ESD activities, there are very few research studies on the exact meanings of that students assigned to SD. Therefore this study evaluates the images of SD in the ESD movement among Japanese students. Research findings will be contribute to consider how we should evaluate and improve ESD programmes for the future.

VIEWS ON SCIENCE, TECHNOLOGY AND SOCIETY OF A GROUP OF TEACHERS OF PRIMARY SCHOOL

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It is necessary to develop a science teaching in schools that promotes scientific literacy (AC) so that citizens have a world view appropriate to their socio-cultural context and can then position themselves appropriately in socio-scientific issues that interfere with our wellbeing and our daily lives, knowing make responsible decisions, both individual and the collective. In this paper, we report that it was observed that all teachers attach great importance to the content of the science curriculum for the early grades of elementary school, as well as presenting a significant concern for the development of children showed that when is important to teach science to arouse curiosity, promote enthusiasm, develop reasoning, beyond the experience and understanding of the phenomena through the experiences. Teachers also had visions neutral, decontextualized, ahistorical on Science, Technology and Society, also showing a linear view of development and social welfare, which depends on development of Science and Technology. Regarding the questionnaire VOSTS applied late in the first period of the course, the most teachers demonstrate concepts suitable, therefore most of the answers are within the realistic category. Many responses also reveal conceptions within the Acceptable category. Just one teacher had a greater number of conceptions within the category Naive

NATIVE OR RAW STARCH DEGRADATION EMPLOYING AMYLASE PRODUCED BY ASPERGILLUS FLAVUS NSH9

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Production of amylase by *Aspergillus flavus* NSH9 via solid state fermentation (SSF) using sago hampas as substrate was performed and investigated. The enzyme activity produced was recorded as 1.478 U/mL and further used in the hydrolysis of raw starch. Estimation of the amylase degrading ability on different starches was determined. Cassava starch recorded the highest percentage of raw starch hydrolysis followed by sweet potato, sago and yam. Analysis of the ultrastructural observation of the degraded starch granules employing the scanning electron microscope (SEM) revealed that raw starch granules appeared with surface erosion pattern.

Key words: amylase, solid state fermentation (SSF), sago hampas

INTRODUCING STUDENT CENTRED APPROACHES IN PRE-SERVICE SCIENCE TEACHER EDUCATION IN CAMBODIA

Stefaan Vanda Walle

This paper discusses the introduction of student-centred instructional methods in public teacher training institutes in Cambodia. Over a 5-year period science lecturers have been supported in replacing rote learning by student-centred learning through regular training, follow-up sessions and suitable teaching resources. The paper describes findings and a lesson learned in capacity development and student-centred science education and relates these to the wider context of science education in low-technology environments. Workshops, teaching resources and coaching sessions are based on the TPACK framework. A key element is that applying a student-centred approach or technology in itself is not sufficient to improve teaching and learning quality, but requires a negotiated balance between content knowledge, pedagogy and technology. It is argued that the programme has succeeded in improving the capacity of teacher trainers and selected teachers to adopt student-centred instructional methods. However, negative incentives in the education system such as weak accountability structures limit the impact of the programme. Organisational capacity building of other stakeholders in the 'education game' needs to complement individual capacity building of teacher trainers. The paper is based on a programme from the Flemish Association of Development Assistance and Technical Cooperation (VVOB), implemented between 2008 and 2013.

ACCESSIBILITY CHALLENGES TO SCIENCE EDUCATION IN CAMBODIA: AN INSTITUTIONAL ANALYSIS

Stefaan Vanda Walle

This paper explores some of the challenges disabled people in Cambodia face to access education. The focus lies on science teacher education, although many arguments apply more widely. The aim is to provide a framework to analyse accessibility challenges learning for disabled learners. The Khmer Rouge regime was a massive setback for the education system in Cambodia. The country has made strong progress to mend its education system. Ratification of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) legally binds the government to work on inclusive education. North's framework of institutional change is used to discuss alignment of formal rules, informal constraints and their enforcement characteristics as a precondition to improve accessibility to science education. Informal constraints are arguably strong in Cambodian education and include prejudices against education for disabled people, learning online and student-centred instruction methods. Socio-economic constraints include a poor return on education investments due to low social mobility and lack of employment opportunities, fatalism about the value of education and entrenched informal payments. The absence of an independent and accessible judicial system, widespread corruption and lack of information on rights and procedures complicate effective enforcement. Some suggestions for development organisations are included.

OVERCOMING BARRIERS TO TEACHING SCIENCE IN PRIMARY EDUCATION

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Science literature has numerous studies on the barriers which impact on meaningful learning in science, and in particular to this presentation, primary/ECE/elementary school science. This presentation reports on a two-year study that explicitly seeks to both discuss and address four barriers of meaningful learning: science language, learner, teacher, and school. These have been identified in studies from around the world as common barriers to relevant, useful, and meaningful science education. For example, science language has been reported by students to be too difficult to learn. Similarly, studies have highlighted the learner as a barrier due to lack of motivation or readiness; the teacher's self-efficacy or perceived lack of content knowledge as a barrier; and finally, the school due to a lack of resources, not enough time for meaningful content, and/or class sizes too big. The intent of this presentation is to discuss a research study that explicitly includes four strategies which supported teachers establishing meaningful learning environments for students. These four strategies are: (1) Students learn what they do; (2) Social construction of learning; (3) Effective science investigations begin with a question; and (4) Effective science inquiries are managed by the students themselves and are guided by the question.

RELEVANT, USEFUL AND MEANINGFUL SCIENCE FOR PRIMARY/ECE/ ELEMENTARY SCHOOLS ON A MINIMAL BUDGET

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It has been reported that much of the science taught in schools is not especially useful in everyday life. This has been the case for example in New Zealand (Bull, Gilbert, Barwick, Hipkins, & Baker, 2010), Australia (Tytler, 2008), England (Osborne, Driver, & Simon, 1986) and Sweden (Lindhahl, 2003). Three reasons are commonly reported for this ineffective approach to science in schools: teachers' self-reported lack of content knowledge in science, a perceived lack of resources for teaching science, and sufficient time for effective teaching of science due to the crowded curriculum (Education Review Office, 2012; Fisher, 2010; Fraser, Aldridge, & Adolphe, 2010; Novak, 2002). While there is a considerable amount of literature around the research into supporting the continued professional development of teachers' content knowledge (see for example Appleton & Kindt, 1999; Duschl, Schweingruber, & Shouse, 2007; Harlen & Holroyd, 1997), this workshop is designed to demonstrate through practical hands-on activities how teachers are able to overcome the perception of lack of resources and time. It is the explicit intent of this workshop to demonstrate how to present relevant, useful and meaningful science at the primary/ECE/elementary school level (Sexton, 2011).

CONCEPT CARTOONS: WHAT HAVE WE LEARNT?

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Concept Cartoons were created approximately 20 years ago as an innovative response to the challenges of taking learners' ideas into account in science inquiry. At that time the theory supporting a constructivist approach to teaching and learning seemed compelling, but the practicalities of implementing this in the classroom were – and still are – a huge challenge for teachers. Concept Cartoons were an attempt to connect theory with practice, providing a bridge between eliciting learners' ideas and using science inquiry to challenge their ideas. Initial research into the approach indicated that Concept Cartoons encouraged learners to engage positively in science lessons (Keogh and Naylor, 1999). Typifying the response of learners is a quote from a high school student, aged 12. There are lots of naughty children in this class, but we are busy and better behaved . . . even Dennis, the naughtiest boy in our class, wanted to stay in at playtime and carry on discussing. Since then, Concept Cartoons have become a commonly-used strategy that promotes transformation of science teaching and learning around the world. Teachers find them easy to use in the classroom and learners find them challenging and engaging. They are used in a wide variety of learning settings, and they have been created in other subjects including sport and fitness, mathematics and English.

For some years Keogh and Naylor's research provided the only evidence into the impact of Concept Cartoons in the classroom. More recently a wide range of researchers, many of them from outside the UK, have added to that research base, using evidence from school students, university students and practising teachers (e.g. Chin and Teou, 2009; Sexton, Gervasoni and Brandenburg, 2009).

TALKING SCIENCE- A PROJECT IN RURAL BANGLADESH TO INCREASE SELF ESTEEM OF WOMEN THOUGH HEIGHTENING THEIR AWARENESS OF THEIR KNOWLEDGE OF SCIENCE AND TECHNOLOGY FROM THEIR EVERYDAY LIVES AND TALKING TO THEIR CHILDREN

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This paper addresses the theme of CASTME and STEM. The Commonwealth Millennium goals include, achieving primary education for all with emphasis on girls, enhancing science and engineering, improving literacy of women. This CASTME initiative, 'Mothers Talking Science', is concerned with two goals, 1. Achieve universal primary education 2. Promote gender equality and empower women. This pilot in rural Bangladesh aims to increase self-esteem of women heightening their awareness of their knowledge of science and technology from everyday lives. The women have no school qualifications. The majority had not attended school or had received minimum primary education. They live in a special village with their children whilst acquiring skills, which will enable them to return to a community and support themselves. They identified everyday science and engineering, chose that which interest them and photographed it with digital cameras and the pictures can then be printed. Using materials they have made they produce "Big Books" which they share with their children and others, thus 'Talking Science'. Data indicate that the project not only increased the understanding of science in their lives but raised the self esteem of these women increasing their literacy as well as meaningful interaction with their children.

TEACHER QUESTIONS IN INQUIRY BASED SCIENCE-THE SWING GAME WITH 5 YEAR OLDS IN AN ENGLISH SCHOOL

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Inquiry-Based approach in Science Education (IBSE) with young children of ages 3-11 years is the focus of attention across Europe. Inquiry based science aims to achieve this through providing educational material as well as professional development opportunities for teachers in various ways. Many projects aim to achieve these objectives by developing hands on science activities, networking teacher and academics across Europe and recognising and celebrating successful practice and research on IBSE with young children. Questions from the teacher and from a learner are a key part of inquiry-based science. This paper reports on an analysis of the questions used by a teacher working with 2 learners at an activity. The questions are analysed according to the schema proposed by Chin (2007). The questions suggested in the directions for the activity were ignored by the children who investigated the equipment, made their interpretation and devised their own investigation in a true inquiry child based approach not a directed one. Young children do not respond in the way of older children and form their own questions and develop their own inquiry Implications for teaching and learning discussed.

DEVELOPING THE SCIENTIFIC CURIOSITY OF 3 TO 7 YEAR OLDS

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The Welsh Foundation Stage for 3 to 7 year olds is based on child-initiated learning. This workshop looks at how using simple everyday story time books (Owl Babies and Barry The Fish with Fingers) can lead to scientific investigation, by both teachers and pupils. Participants will use basic classroom resources to explore natural habitats; food chains; defence mechanisms and bubbles. This workshop will demonstrate to teachers that by following their pupils' instinctive curiosity, joining up school visits, classroom resources and accessing free resources, scientific investigation in the very young is not difficult and provides an environment where both staff and pupils can acquire new information from classroom activities. Participants will also share experiences of how story time can open doors to other classroom topics.

THE INFLUENCE OF SCHOOL SCIENCE TEACHERS - THE DIFFERENTIAL IMPORTANCE ATTRIBUTED BY MALES AND FEMALES TO ENCOURAGEMENT FROM SCIENCE TEACHERS.

Sue Wilson

Research on the achievement and retention of female students in science and mathematics is located within a context of falling levels of participation in physical science and mathematics courses in Australian schools, and underrepresentation of females in some science, technology, engineering and mathematics (STEM) courses. The Interests and Recruitment in Science (IRIS) project is an international project that aims to contribute to understanding and improving recruitment, retention and gender equity in STEM higher education. Nearly 3500 first year students in 30 Australian universities responded to the IRIS survey of 5-point Likert items and open responses. This paper explores gender differences in first year university students' responses to three questions about important influences on their course choice.

The IRIS study found good teachers were rated highly by both males and females as influential in choosing STEM courses, and significantly higher numbers of females rated personal encouragement from senior high school science teacher as very important. In suggestions for addressing sex disparities in male-dominated STEM courses, more females indicated the importance of good teaching/encouragement and more females said (unspecified) encouragement. This study relates to the influence of school science teachers and results are discussed in relation to implications for science education.

THE INFLUENCE OF ORGANIC CONTAMINANTS FROM HOSPITAL WASTE DUMPS AND INCINERATOR ASH ON THE RECEIVING ENVIRONMENT

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Since beginning, the hospitals are known for the treatment of sick persons but are unaware of the adverse effects of the garbage and filth generated by them on human body and environment. Now it is a well-established fact that there are many adverse and harmful effects to the environment and human beings which are caused by the hospital waste generated during the patient care. Hospital waste is a potential health hazard to the health care workers, public and the flora and fauna of the area. Hospital acquired infection, transfusion transmitted diseases, rising incidences of hepatitis B, and HIV, increasing and water pollution lead to increasing possibility of contracting many diseases (Akter, 1998). Air pollution due to emission of hazardous gases by incinerators such as furan, dioxin, hydrochloric acid etc. have compelled the authorities to think seriously about hospital waste and the diseases transmitted through their improper disposal. Wastes generated principally from health care institutions may represent a serious health hazard and little or none is known about the health hazard of hospital wastes in Zaria metropolis, Nigeria

SHAPING YOUNG MINDS: AN INTERACTIVE WAY OF SCIENCE TEACHING AT PRIMARY SCHOOL LEVEL

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Science and mathematics subjects have always remained a matter of concern and challenge to learn and understand by the students and teachers as well. Scholars of science teaching introduced many ways to teach science by making use of various teaching aids. Using age-old charts and models as teaching aids, have served limited purposes.

The unique experience of using cost-effective material to make working models for understanding of various concepts for explaining scientific activities was found to be quite useful. The experiment was executed on primary school children of government schools in rural area of capital city. The students had been selected for science scholarship scheme. During the one-month camp for these students, each day two hours were devoted to this activity. The effort resulted into substantial increase in number of scholarship in science. The increasing interest of students in learning science has also resulted into establishment of science clubs in the schools. These clubs have made this activity as a part of science curriculum. To make science more interesting, activity based teaching and involvement of students are some important and effective steps. The use of cost effective material can prove a bonus especially to the developing nations.

Keywords: cost-effective material, working models, science club, effective

GLOBAL NETWORK FOR GLOBAL EDUCATION: OUTREACH OF THE LIGO SCIENTIFIC COLLABORATION

Szabolcs Marka

The goal of the LIGO Scientific Collaboration is to convey the knowledge, excitement, and potential of the field of Gravitational-wave Astrophysics to the public of all ages, occupation, and preparation. The direct detection of gravitational-waves with the Laser Interferometer Gravitational-wave Observatory (LIGO) promises to open a revolutionary new window on the Universe, which shall probe some of the most violent and energetic phenomena in the cosmos - from black holes and supernovae to the Big Bang itself. Within its core mission, the LIGO Scientific Collaboration includes the initiative to harness the excitement and enthusiasm generated by gravitational-wave research to inspire and educate students and the general public in astronomy and fundamental science, thus raising standards of science literacy and education. Our researchers and students believe that the opportunity to discover the beauty of the cosmos should not be limited by age, culture or socioeconomic background. This review will provide a comprehensive and illustrated view of the rich menu of possibilities of constructive Education and Public Outreach contributions of the LSC.

BIODEGRADATION OF DETERGENTS BY AQUATIC BACTERIAL FLORA FROM OTAMIRI RIVER, NIGERIA

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The utilization of Omo®, Jet® and Persil® detergents by aquatic bacteria isolates from Otamiri River at Nekede in Owerri North, Imo State, Nigeria was investigated. Identification tests for bacteria isolates from Otamiri River revealed them to belong to the genera Bacillus, Micrococcus, Escherichia, Enterobacter, Klebsiella, Pseudomonas, Actinomyces, Corynebacterium, Serratia and Staphylococcus. Detergent utilization studies revealed total heterotrophic count of 3.38, 3.40, 3.36 and 5.35 log cfu/ml and 2.08, 2.20, 1.95 and 3.48 log cfu/ml obtained at 0 and 48 h for Omo®, Jet®, Persil® and control experiment, respectively. At 96 and 144 h, 2.37, 2.35, 2.25 and 2.47 log cfu/ml and 2.39, 2.37, 2.35, and 2.46 log cfu/ml were obtained. While counts of 1.70, 2.37, 1.38 and 2.4 log cfu/ml were obtained at 192 h for Omo®, Jet®, Persil® and the control experiment, respectively. Of the nine bacterial isolates obtained from the river water, only Pseudomonas, Bacillus, Actinomyces, Corynebacterium and Staphylococcus were found to survive in the detergent water and possibly utilize the test detergents. Isolate specific detergent utilization test revealed these isolates to be capable of utilizing the test detergents in single and combined forms with Pseudomonas showing the highest ability while the least was observed for Staphylococcus. Statistical analysis revealed significant changes in optical density of detergent broth challenged with the test organisms, with the organism showing more ability to utilize, Omo® and Jet® than Persil® detergents. The result obtained, however, reveals the ability of natural aquatic bacterial Isolates to degrade detergents in aquatic ecosystem.

Key words: Aquatic bacterial flora, detergents, biodegradation, Otamiri River, Nigeria.

EFFECTIVENESS OF REALISTIC SIMULATION AND NON-REALISTIC SIMULATION ON STUDENTS' ACHIEVEMENT AND MEMORY RETENTION IN THE LEARNING OF CELL DIVISION

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The effects of realistic simulation and non-realistic simulation were examined on 136 Malaysian Form Four Biology student's achievement and memory retention in the teaching and learning of Cell Division. Student's perceptions about the realistic simulation and non-realistic simulation also were identified. This quasi experimental study was conducted for six weeks and employed a quantitative research method through a set of pre test, post test (post achievement test and post memory retention test) and questionnaire (perceptions). In the analysis, there are two types of statistics such as descriptive statistics and inferential statistics such as paired samples t-test and one way ANCOVA were involved. The results revealed that there were significant differences in students' achievement and memory retention between realistic simulation and non-realistic simulation group. The experimental group who taught with realistic simulation performed well, have high memory retention about the learnt concepts and positive perceptions about the realistic simulation than the control group who taught with non-realistic simulation. Meanwhile, some control group students have negative perceptions about the non-realistic simulation. The findings revealed that realistic simulation known to be an effective educational tool in the teaching and learning of Biology.

KEYWORDS: Realistic simulation, non-realistic simulation, Malaysian Form Four Biology students, achievement, memory retention, Cell Division, perception

FUNCTIONAL STUDY OF PREL2A GENE IN ZEBRAFISH

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Ena/VASP family proteins are conserved family of action regulatory proteins. It acts as important regulator of cell migration by assembly and undergoes rearrangement during lamellipodia and filopodia formation. Proline-rich EVH1 Ligand (PREL) family proteins are adaptor proteins consist of Pleckstrin Homology (PH) domain and Ras-association (RA) domain. It has reported as one of the binding partner of Ena/VASP proteins and colocalizes with them at the tips of lamellipodia and at focal adhesions in respond to Ras activation. However, the exact mechanisms on how is the interaction between PREL and Ena/VASP family proteins remain largely unknown. In zebrafish, we have indentified three members of PREL family proteins (PREL1, PREL2a and PREL2b). Hence, in this study the functional roles of PREL2a were studied through gene expression pattern in zebrafish. To establish the expression pattern of PREL2a in developing zebrafish, total RNA was isolated from 10 embryonic stages of zebrafish which comprise of 3hpf, 8hpf, 11hpf, 18hpf, 24hpf, 36hpf, 48hpf, 72hpf, 96hpf and 120hpf. Reverse Transcriptase-PCR revealed that PREL2a was expressed along the embryonic development in zebrafish, started from 3hpf and remained until 120hpf. The findings provide and insight that PLEL2a plays important roles during zebrafish early embryonic development.

Keywords: PREL2, Ena/VASP, Zebrafish

ENHANCING EFFICIENCY OF STUDENTS' STUDY AND PROBLEM SOLVING IN MATHEMATICS PLAN AND ELEVATION BY "EZ DRAW" TECHNIQUE

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It was found that most students of secondary schools cannot imagine the correct views of three dimensional objects and hence, fail to solve the problem in Plan and Elevation. "EZ draw" which focuses on determining the critical points are innovated so that accurate solving steps could be carried out in a short time. The research involves both quantitative and qualitative approaches. Quantitative data were collected from the result of topical test without any knowledge of "EZ draw" technique and topical test with the practice of the technique. From the analysis data by SPSS(V 17) consist of 99 students, 73.74 % show an increment in the test. Mean marks increased from 60.19 (Pre-test) to 70.49 (Post-test). T-test produced a significant result (sig.=0.000). Researcher-created questionnaires from 37 respondents show that 86% students "EZ Draw" really helps them in comprehending the mathematical concept and improving mathematical solving skill. The analysis clearly shows that "EZ Draw" has successfully enhanced the efficiency of problem solving in Plan and Elevation.

TOOLS AND MODELS FOR TEACHING EINSTEINIAN PHYSICS

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This paper describes a set of inexpensive resources to aid the teaching of Einsteinian physics. First we describe the need for special equipment for visualizing the concepts of Einsteinian physics. Then, we provide brief descriptions of each teaching aid. The talk will include video clips to illustrate all of the teaching aids discussed here.

PROMOTING STUDENT ENGAGEMENT AT STEM FOCUSED PUBLIC SCHOOL WITH HIGH POVERTY

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STEM (Science Technology Engineering Math) focused public schools with high poverty rate often face challenges related to engagement. The paper related to the use of a STEM Expo to promote engagement among students and partnerships with community organizations and industry are presented. Experiences, strategies and lessons learned are shared. Results of focus groups and surveys are presented. The presenters will share best practices in organizing a city-wide STEM expo to establish effective partnerships between a Title I urban middle school and community organizations, governmental agencies, private industry and universities. The Baton Rouge STEM Expo was the first of its kind in Baton Rouge and attracted hundreds of parents, students, partners and guests. The partnerships with diverse groups in the business, governmental and academic communities gave the event credence among groups the school otherwise would not have reached and helped make the expo a success. An aggressive media campaign secured positive news coverage of the event, giving the school and its partners positive publicity. The presenters will detail best practices for soliciting and maintain the partnerships, planning the event, securing media coverage and how to leverage past experiences into future success. Attendees will learn how a Title I school developed effective partnerships with external groups to become a STEM pioneer in South Louisiana.

ADAPTATION OF LOCAL PLAYS FOR PRIMARY SCHOOL PUPILS' INSTRUCTIONAL INTERACTIONS IN NUMBER AND SHAPE RECOGNITION

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Learning at most Nigerian public primary schools is largely the teacher centred approach to instruction. Several studies have revealed that primary school teachers do not utilize instructional materials. An attitude which they complexly attribute to lack of sufficient government funding of education but which is partly lack of resourcefulness on part of the teachers(Ekpo,2010 & Ibe-Bassey, 2012). Ekukinam (2009) conducted a study to assess the relevance of learning resources utilized by teachers in the upper basic Primary level to selected instructional objectives in English language. The study revealed that for the learning resources utilized by teachers, pupils are provided little or no interaction with other pupils and even the learning materials. The few interactions indicated a linear form of communication where information is sent out and is received at the other end with no interaction to ensure that the recipient has reacted favourably to information received. This step only allows information to leave one object to another without a feedback on the reaction of (or) on the receiving object. An indication that learning resources utilized, present content area to students without opportunity for recall and recognition of facts presented. In a situation where pupils are not exposed to learning experiences through the use of other learning materials apart from the teachers, the level of interaction is limited. It is based on this backdrop that the researcher looks at the aptness of adapting local play for effective teaching and learning and increasing interactions between the learner and the other components of an instructional situation.

COMPARATIVE EFFECTS OF REFORMULATION OF KNOWLEDGE AND INQUIRY METHODS OF TEACHING ON STUDENTS' PERFORMANCE AND RETENTION OF ECOLOGICAL CONCEPTS IN BIOLOGY

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The study examined the relative effectiveness of reformulation of knowledge, guided inquiry and expository methods of teaching in enhancing students' performance and retention of concepts in ecology. In pursuance of the objectives of the study two research questions and two null hypotheses were formulated to guide the study. Non-randomised pretest – posttest-control group design was used to select 148 SS2 biology students from three co-educational secondary schools in Etinan Local Government Area in Akwa Ibom of Nigeria who constituted the sample. A researcher developed Achievement Test in Ecology (ATE) was used in collecting the data. The result of data analysis using Analysis of Covariance (ANCOVA) showed students taught using Reformulation of knowledge approach performed significantly better than those taught with guided inquiry and expository methods. Those taught with expository method had the least performance. Their retention also followed the same order. Consequent upon these observations, it was recommended among others that biology teachers should always adopt the reformulation of knowledge teaching method or some related strategy in teaching difficult concepts in Biology.

THE EFFECT OF THE VIRTUAL LABORATORY ON STUDENTS' ACHIEVEMENT IN BIOLOGY

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In Biology education, laboratory activities increase students' interest in the subject matters covered in the class and help their learning. Due to lack of laboratories at schools or insufficient instruments in laboratories, hands on experiments are rarely performed in some schools in Plateau. However, such experiments can be virtually done as a result of recent developments in Information Technology. In this study, a virtual laboratory related to 'concept of cell' for senior secondary II students was prepared and its effects on students' achievements and attitudes were investigated. For this aim, 16 virtual experiments prepared by using flash program and used in the experimental group. Result of this study showed that virtual laboratory applications made positive effects on students' achievements and attitudes when compared to traditional teaching methods

JAPANESE ELEMENTARY SCIENCE HANDS-ON ACTIVITIES: APPLICABLE TO THE PHILIPPINES?

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Considering Japanese educational assistance activities, applicability of Japanese science hands-on activity to the Philippines is examined. One-day workshop to Filipino 16 pre-service teachers, who study for elementary teacher in undergraduate, is conducted using translated Japanese textbook and science kit in English. Two physical science activities are introduced to pre-service teachers. They are asked to read textbook, made prediction and conduct hands-on activity individually, and report the result. And materials that substitute Japanese science kit are explained also. We found that participants' experience and knowledge of hands-on activity and related scientific knowledge are limited. Their perception on the aim of practical work is changed; they admit more the importance of observation, recording and manipulative skill as the aim of practical work after the workshop. Their response on the Japanese textbook and science kit are positive and they mentioned advantages in educational aspect. They also mentioned the advantage of contents of textbook such as many pictures and illustrations, and comprehensibility of information. We found that generally the workshop is acceptable to the participants.

EFFECT OF VIDEOTAPED INSTRUCTION AND THE LEARNING CYCLE CONSTRUCTIVIST MODEL ON SECONDARY SCHOOL PHYSICS STU- DENTS' INTEREST AND ACHIEVEMENT

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The study investigated the effect of Videotaped Instruction, and the Teaching Learning Cycle (TLC) method on secondary school students' interest and achievement in physics. Two hundred and thirty-four (234) senior secondary school two (SS2) physics students from four coeducational schools in Umuahia, Abia State, Nigeria were exposed to videotaped instruction and the Learning Cycle treatments. The study adopted the non-randomized pre-test post-test control group design. Two schools were randomly assigned to videotaped treatment group and two to TLC treatment group. The instruments used to determine the achievement and interest level of the students were a ten-item, essay format Physics Achievement Test (PAT) and a 4-point scale Interest Inventory Test (IIT) respectively. The coefficient of stability for PAT and IIT was established using spearman's test-retest coefficient of reliability and were found to be 0.91 and 0.92 respectively. The research questions were answered using means and standard deviation while the hypotheses were tested at $P < .05$ probability level using Analysis of covariance. The TLC method facilitated students' interest and achievement better than the videotaped instruction, because TLC provided students with a lot of time for productive engagement through activities. Both male and female students improved in their interest and achievement scores, with male students having slightly higher mean achievement scores than their female counterparts

INTEGRATION OF ICT IN BIOLOGY TEACHING: A CASE STUDY OF A TERTIARY TEACHER EDUCATION INSTITUTION IN NIGERIA

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The progress of any country depends upon the quality of education offered to its citizens, especially those that are expected to drive the economy of that country. Teaching at the tertiary level is becoming one of the most challenging tasks in the Nigerian society given the ever increasing knowledge base and the rapidly expanding modern technologies. All these are making demands on the teachers' time as the teachers need to be conversant with and use ICT in teaching to continue to be relevant. While these technologies increase teachers' training needs, they also offer part of the solution teachers need to meet up with 21st century learners. Information and communication technology (ICT) can provide more flexible and effective methods of teaching for teachers, improve teacher training, and connect teachers to the global teacher community. The management of Federal College of Education (FCE), Yola has made great efforts and major financial investments to implement ICT into teaching and learning. ICT tools have been provided to Biology teachers Education (FCE), Yola has made great efforts and major financial investments to implement ICT into teaching and learning. ICT tools have been provided to Biology teachers by establishing two e-classrooms in the Department of Biology, School of Sciences to assist in the integration of ICT in teaching some difficult topics in Biology. This paper is an attempt to assess the effect of this ICT training on the performance of student teachers in the biology education programme of FCE, Yola. Preliminary findings reveal that the interest and attitude of the student teachers to the courses using ICT have increased. More students attend lectures and actually look forward to being in the ICT room.

Creating Science within and beyond the Classroom: Strategies for Africans Learners

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The paper creating science within and beyond the classroom: strategies for African learners covers the following: basic issues and strategies. The basic issues treated are science and the African learner, science language, students' interest and science, and loving science. The strategies are: raise a strong argument against a belief, make your science real, challenge the learner, follow curricula specification, customized or indigenized classroom interaction. Others are management of cognitive crises; let the child own up the science class, provocative science lesson, preemptive teaching, Transcendence teaching, innovation, listening skills, and Appeal to stakeholders. Some recommendations are made such as Stakeholders in education should create an enabling environment to ginger creation in science

A FOCUS ON INQUIRY-BASED TEACHING AT A DIVERSITY OF SCHOOLS IN SOUTH AFRICA

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This study investigated the perceptions of physical sciences teachers on the implementation of inquiry-based learning at a diversity of schools in South Africa. This study focused on three key issues in the implementation of inquiry, namely the benefits that are perceived to accrue when learners do inquiry, degree of autonomy learners are allowed during inquiry, and the competence of teachers in enacting inquiry in their practice. The findings show that teachers at all locations of school have a positive perception of inquiry-based learning, with benefits for learners that include the development of experimental skills and making science more enjoyable. However, with regard to inquiry facilitating conceptual understanding, teachers at township and rural schools believe a didactic approach to be more effective than learners doing inquiry. The significance of this study is that despite teachers across all types of school having positive perceptions of inquiry-based learning, the lack of resources, large classes, and the poor educational background of learners in inquiry at township and rural schools constrain the implementation of inquiry-based learning at these schools and result in teachers at such schools resorting to a didactic pedagogy.

CONCEPT MAPPING STRATEGY OF LEARNING SCIENCE TO ENHANCE CONCEPTUAL CLARITY AMONG SECONDARY SCHOOL VERNACULAR MEDIUM STUDENTS

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The effective learning of specific scientific subject requires not only the knowledge of different concepts that the subject contains, but also the adequate relation among such concepts in order to obtain a satisfactory meaning of them. Most of the science learning involves a lot of verbal jargon, making it difficult for students to understand the links between the concepts and sub concepts thus promoting rote learning. It becomes all the more difficult for vernacular medium students. This paper presents the effectiveness of concept mapping technique in enhancing the conceptual clarity in science among vernacular medium class VIII students when used as a tool for teaching, learning and evaluation.

THE ROLE OF THREE DIMENSIONAL MIND MAPPING IN TEACHING AND LEARNING OF SCIENCE AT EARLY CHILDHOOD LEVEL

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It is believed that the quality of education at early childhood level greatly shapes the learning that occurs later in life. In this regard the Ministry of Education and Human Resources in its strategic plan 2008-2015 stipulates that we provide quality curriculum at pre-primary level (3-5 years) and has laid much emphasis on the knowledge, skills, attitudes and values to be gradually acquired and developed during pre-primary years. It focuses on learning which will allow young children to acquire language skills for effective communication and meaningful interaction with self and others, enjoy learning by experiencing, participating in arts, music, dance, drama, appreciating the diversity of Mauritian culture and interacting positively among themselves as mentioned in policy documents. Therefore, this study was planned to translate Ministerial policy decisions into practice taking into consideration an innovative practice that would motivate young learners into learning of the parts of their body and related hygiene. A 3-Dimensional mind mapping has been used for the lesson implementation. This tool proved to be influential in motivating early childhood learners aged 4 plus to develop a basic oral vocabulary in Science and polish their communication skills in English, French and Mauritian Kreol languages.

COMPARATIVE STUDY OF IODINE NUTRITURE OF SCHOOL-AGE CHILDREN BETWEEN THE AGES OF (6 – 12) YEARS IN TWO LOCAL GOVERNMENT AREAS OF IBADAN

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Iodine Deficiency (IDD), Control programmes and Monitoring need to be constantly sustained due to the fact that IDD simply reappears if salt iodization is interrupted; hence, it is necessary to reassess communities after several years of iodised salt in Nigerian households. This study was then carried out to determine and compare the current iodine status of the school-age children in two Local Government Areas (LGA)s of Ibadan. Four hundred school children aged 6–12 years participated, 200 were males and 200 were females. Casual urine samples, household salt samples, thyroid volume size were determined. Median (UI) in these school-age children was 106µg/L. The population proportion with UI levels below 100µg/L and 50µg/L in the two areas of study were < 50% and < 20% respectively, hence, revealed optimal iodine nutriture. The analysis of table salt from the households showed that 92.0% and 78.5% (11.5% short of the benchmark) in the studied areas consumed salts with adequate iodine content of equal to 15ppm. This difference was statistically significant ($p < 0.05$). The Total Goiter Rate (TGR) was 20%. Visible goiter prevalence were 3% and 8.5% in Ido and Ibadan-North LGAs. This difference was statistically significant ($p < 0.05$) in the areas of study.

BIOLOGICAL CONTROL OF BASAL STEM ROT (BSR) OF OIL PALM USING PENICILLIUM CITRINUM, PENICILLIUM PINOPHILUM AND BURKHOLDERIA GLADIOLI IN COMBINATION

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A combination of three microorganisms, *Penicillium citrinum*, *P. pinophilum* and *Burkholderia gladioli*, that have been shown as antagonist to the pathogen, *Ganoderma boninense* was used to control basal stem rot (BSR) in oil palm. The mixed antagonists inoculum was prepared in a water-based formulation of 2.7×10^7 cfu/ml at 25-27 °C. Vegetative growth of the mycelium of *G. boninense* was inhibited after 21 days when the pathogen and the mixed antagonists inoculum were grown on media in a same Petri plate. The growth of the pathogen was reduced by 61.75 % by forming zone of inhibition. The mixed antagonists also caused swollen at the hyphae tips of the pathogen. Oil palm seedlings that were treated with the formulation resulted significant reduction of disease severity index (DSI), root dry weight and chlorophyll content as compared to the seedlings infected with the pathogen only. No necrotic lesion was seen at the trunk base of the antagonists treated seedlings after 5 months observation. Thus, this formulation can be as the potential combination of antagonists in controlling BSR disease of oil palm.

TRIS-THIOUREA DERIVATIVES AS POTENTIAL ANTIBACTERIAL AGENTS.

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Research on thiourea compounds with more than one thiourea moieties has now become a focus of interest among researchers. The presence of more thiourea moieties not only expands the supramolecular architecture but also enhance their effects towards the growth of bacteria. Thus, in this paper we report on the synthesis of some novel tris- thiourea derivatives that consist of three thiourea moieties formed by the reaction between isothiocyanates intermediate with aniline and series of chloroaniline respectively. All the synthesized products were characterized by elemental analysis CHN, FT-IR spectroscopy as well as ^1H and ^{13}C NMR spectroscopy. The antibacterial activities of all synthesized compounds were examined via turbidimetric method and all products showed very significant effect against the growth of gram-negative bacteria (*E. coli* ATCC 8739).

Education at the Confluence of Neuroscience Research and the Digital Revolution

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Education is beginning a transformation that is disrupting the basic learning model in place for several centuries. Two forces are fueling this unprecedented shift in educational practices. Extraordinary advances in neuroscience research emphasize the social aspect of learning, the need for personal human interaction and for younger science students, the hands-on manipulation of physical objects during the learning process. At the same time, the “hi-tech” digital revolution has created the opportunity of using physically distant, “virtual teachers” (and/or peers) and interactive visualizations and simulations to either supplement or supplant the “soft touch” approach of direct, face-to-face human interactions. To counterbalance the unavoidable transition to teaching via digital technologies in higher education, it is imperative to invest comparable resources on early childhood and elementary science education. During this critical developmental period of life, teachers can create the social context necessary for young students to develop confidence in their communication and social skills as they learn fundamental concepts when they are most receptive to learning. After this foundation is in place, students can adapt to the more abstract Digital Education Revolution armed with the ability to think clearly and logically. Such well-educated students will not be seduced by technology as a replacement for human interaction, but will use it as a powerful means to extend the range of their interactions and unite humans in a truly global learning community.

RELATIONSHIPS BETWEEN THE METACOGNITIVE ORIENTATION OF SCIENCE CLASSROOM ENVIRONMENTS AND BELIEFS ABOUT SCIENCE & SCHOOL SCIENCE AMONG PRESERVICE SCIENCE TEACHERS

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Past studies have found that resistance to a constructivist perspective can be attributed in part, to the image that teachers hold about the nature of science as these beliefs influence the way in which science is taught. Traditional or objectivist views of science have been associated with teacher dominated modes of instruction and when the practices of science teachers are governed by an objectivist image of the nature of science, it is difficult for a constructivist perspective to become reality within the classroom. On the other hand, an important goal of education is to develop students as metacognitive, life-long learners. Metacognition refers to an individual's knowledge, control and awareness of his/her learning processes. The metacognitive orientation of a learning environment is the extent to which that environment supports the development and enhancement of students' metacognition. The main purpose of this study is to investigate the relationships between the metacognitive orientation of science classroom environments and beliefs about science and school science, which both measure issues related to the expected behaviors students adopt when learning science. This study is also aimed to investigate differences in the metacognitive orientation of science classroom environments and beliefs about science and school science based on students' gender. In this study, the Metacognitive Orientation Learning Environment Scale-Science (MOLES-S) will be used to gauge preservice science teachers' metacognitive orientation of science classroom environment whereas the 'Beliefs about Science and School Science Questionnaire' (BASSSQ) will be used to gauge preservice science teachers' beliefs about science and school science. Independent samples t-test will be used to determine the significant difference in the metacognitive orientation of science classroom environments as well as the beliefs about science and school science based on students' gender. Pearson product-moment correlation and regression analysis will be used to investigate the relationships between the studied constructs among preservice science teachers. Keywords: Metacognition; metacognitive orientation of science learning environments; beliefs about science and school science; preservice science teachers.

RELATIONSHIP BETWEEN THE ACQUISITION OF 21ST CENTURY SKILLS AND CHEMISTRY SELF-EFFICACY AMONG SECONDARY SCHOOL SCIENCE STUDENTS

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The main purpose of this study is to investigate the relationships between the acquisition of 21st century skills and chemistry self-efficacy, which both measure issues related to the expected behaviors students adopt when learning chemistry. This study is also aimed to investigate differences in the acquisition of 21st century skills and chemistry self-efficacy based on students' gender. In this study, the 'Malaysian 21st Century Skills Instrument (M-21CSI) will be used to gauge secondary school science students' acquisition of 21st century skills. The M-21CSI consists of five distinctive elements which are: i) Digital Age Literacy; ii) Inventive Thinking; iii) Effective Communication; iv) High Productivity; and v) Spiritual Value. The 'College Chemistry Self-Efficacy Scale' (CCSS) will be used to assess secondary school science students' beliefs in their ability to perform essential tasks in chemistry in terms of self-efficacy for cognitive skills, psychomotor skills, and everyday applications. Independent samples t-test will be used to determine the significant difference in the acquisition of 21st century skills and chemistry self-efficacy based on students' gender. Pearson product-moment correlation and regression analysis will be used to investigate the relationships between the studied constructs among secondary school science students. Keywords: 21st century skills, chemistry self-efficacy, the Malaysian 21st Century Skills Instrument (M-21CSI), the College Chemistry Self-Efficacy Scale (CCSS).

PRODUCTION OF GAHARU OIL IN AQUILARIA MALACCENSIS THROUGH IN VITRO TECHNIQUE

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Gaharu, also known as agarwood or eaglewood, is a resinous fragrant wood produced primarily by trees in the genus of *Aquilaria*. In the world markets, it is traded in various forms, and the sources are mainly from the exploitation of wild plants. Populations of *Aquilaria* species have declined and threatened to extinction. In natural forest, the production of the gaharu is associated with a reaction of the plant cells with wounds and fungal infection. A number of techniques have been developed to artificially induce the formation of agarwood in the wild and cultivated trees. However, it takes long years to get results and produce only low quality or quantity of product. Alternative technique, using cells culture, was developed in the present research that could be the more effective means to produce gaharu. In this technique, cell culture was prepared. Both, solid and liquid media can be used. The growing plant cells (calli) were treated with microbes to induce the formation of gaharu. Essential oils of the products were extracted, and then analyzed using GC-MS. After 6 weeks of treatment, *A. malaccensis* treated calli produced up to 80% similar major group of compound component as in the original gaharu collected from forest. No essential oil produced from the untreated cells.

Keywords: Gaharu, *Aquilaria*, cell culture, GC-MS

ICASE SYMPOSIUM 1 – A set of 4 papers under a single title

A Motivational Approach to Promoting 21st Century Science Learning

Jack Holbrook, ICASE Immediate Past President, Bulent Cavas, Chair of the

ICASE Standing Committee on Publications, Declan Kennedy, ICASE

European Regional Representative, Miia Rannikmae, Chair of the ICASE

Standing Committee for ICASE-University Links

Overall Abstract

A concern, particularly geared to students at an adolescent level, is the perceived irrelevance of the current science learning provision, noting its lack of student interest, abstractedness of the learning and hence its boring nature in the eyes of students (Osborne et al, 2003; EC, 2007). To address these concerns, this symposium introduces a three stage model which emphasizes the promotion of student intrinsic motivation (Deci and Ryan, 1985) as a prelude to initiating inquiry-based science education (EC, 2007) and consolidating the science conceptual learning through transference to socio-scientific situations requiring reasoning and argumentation skills to reach relevant decisions (Holbrook & Rannikmae, 2010).

This symposium introduces an approach supporting teacher ownership of motivational science education, which when suitably supported by teachers' continuous professional development, is shown to enhance the classroom learning environment through carefully constructed teaching/learning modules. While the frame for the learning is student-centred, within an inquiry-based science education (IBSE) setting, this symposium focus on the initial, intrinsic motivational approach and the manner in which this motivation is sustained during the change of emphasis to conceptual science learning in an IBSE setting and reinforced through a socio-scientific decision making stage. The approach is supported by a teaching module which introduces the student learning intended and guides

the teacher by suggesting student activities, the teaching approach to adopt and possibly also give additional supporting ideas for the teacher, such as possible assessment strategies.

This symposium encompasses 4 separate presentations:

1. An elaboration of the philosophical base for the project, indicating the underlying ideas and outlining the various constructs involved;
2. Introduction to an approach through the use of robotics as a motivational, real life approach to exploring scientific concepts through an IBSE approach;
3. Relating IBSE to data-logging and again seeking to address scientific ideas through a more familiar technology-based teaching and
4. Reinforcing teaching through the use of micro-scale experimentation encompassing IBSE within a socio-scientific setting.

Although robotics, data-logging and micro-scale experimentation have purposely been chosen to familiarise teachers with more 21st century scientific interactions in the modern world, the equipment and technology enhanced approach are not the actual focus. The focus is much more on the importance of a context, as opposed to a content, based approach, the need to initiate the teaching from a relevant, familiar scenario within which the students are able to interact, right from square one, and hence allow the teacher to appreciate the value of initiating the teaching from a socio-scientific before moving into a scientific perspective, even with respect to the title of the module. However, as illustrated in the various presentations, there is no intention of watering down the science ideas. The academic challenge through the learning of science remains in terms of conceptual understanding, concept mapping and reasoning.

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Presentation 1. A philosophical approach to enhancing student motivation for the promotion of scientific literacy

Jack Holbrook, University of Tartu, Estonia and ICASE Past President

This presentation seeks to give indicators to guide teachers towards enhancing students' scientific literacy for the 21st century – this seen as the goal of science education in schools. While the frame is very much student centred learning, within an inquiry-based approach to science education (IBSE), it also recognises the importance of student intrinsic motivation to drive the teaching and the value of addressing socio-scientific issues in the teaching and learning of science subjects. When reflecting at an adolescent level on education (where interests in career directions are being formulated), science education needs also to face the challenge of irrelevance to the learning and thus an anticipated student lack of interest, plus the abstractedness of the learning and the difficulty which this brings to the learning in the eyes of students. The symposium addresses these concerns by introducing the idea of 'motivational IBSE' approached not by making the inquiry learning more hands-on and thus more student-centred in the hope this would interest the students, but importantly by seeking to address the teaching in a relevant and familiar context before entertaining science inquiry learning at a structured, guided or open level.

In so doing, the approach being advocated and further illustrated in the following presentations, relates to the need to portray science teaching from a realist perspective, rather than the more usual positivistic approach. For this, attention is placed on seeing science teaching as an integral component of education and thus not isolated from the generic learning identified in the curriculum goals. To encompass all the above, this symposium introduces a new construct – the three stage model (TSM), which sees a socio-scientific aspect of the learning as a stage beyond the initial motivation which in turn introduces the learner to the inquiry-based science education stage. Inevitably in recognising the new direction, evidence-based professional development, based on teacher needs, is considered to be a major necessity. This set of presentations goes some way to giving direction to such a need.

Presentation 2. The Use of Robotics in Motivational Inquiry-Based Science Education

*Bulent Cavas, Dokuz Eylul Universitesi; ICASE Chair of the ICASE Standing Committee
for Publications*

Abstract

Robotics is seen as intellectually rich and a student motivational approach to reaching goals in school science curricula. Robotics applications include mainly hands-on and minds-on activities that are an essential part of science teaching and learning, yet are largely being left out in many national science curricula. Robotics-based education offers students multiple opportunities to design, build and program a robot within the learning of science topics.

The aim of this presentation is to illustrate how robotics can aid a relevant approach to science learning and in this way guide teacher ownership of more relevant approaches to developing scientific and technological literacy. The specific activity is designed to show how robotics can promote learning with grade 6 students geared to:

- reflection occurs when light encounters matter;
- light is absorbed by matter as a result of interaction between matter and light;
- more light is absorbed by dark objects.

By means of a module which specifically includes a front-page, student activities, teacher's guide and further notes, the presentation reflects on the

- introductory approach (a scenario) designed to put the learning into a student relevant context. And also (very importantly) pose the issue whether such use of robotics is feasible in helping to eliminate traffic accidents.
- Points out educational (IBSE) features of the construction of robots which are able to read different wavelengths of light using a light sensor.
- Illustrates the various tests to be carried out on the constructed robots (designed as a model car) to seek ways to prevent traffic accidents.
- Discuss this (Engineering design approach) to the teaching of science in school, particularly for students in the 8-10 age range.

Presentation 3. The Use of Data-logging in Promoting Scientific Literacy

Declan Kennedy, University College Cork and ICASE European Representative

Abstract

An Important direction in the teaching of science subjects in schools is to promote constructivist teaching and hence student involvement, not only in handling equipment but in the much more important area of ‘minds-on’ as well as ‘hands-on.’ The learning needs to involve students in the development of competencies, which can be meaningfully expressed through learning outcomes which go beyond content acquisition and encompass personal and social learning.

The aim of this presentation is to show participants how the use of data-logging can aid a relevant approach to science learning and in this way guide teacher ownership of more relevant approaches to developing scientific and technological literacy. The specific activity is designed to show how data logging equipment can promote learning with transition year students (students in the 15 – 16 age group, but yet to embark on subject specialization at the upper secondary school level) geared to:

- conceptual learning of key concepts related to the behaviour of acids and bases;
- process skill learning related to IBSE problem solving aspects and how the inquiry learning scientific question is posed;
- personal development related to initiative, planning, safety and communication (verbal, written, graphical, etc);
- social development related to (for example) collaborative learning, socio-scientific reasoning, consensus decision making, team presentation.

The presentation will

- Introduce a scenario designed to put the learning into a student relevant context and enabling the socio-scientific issues to be put forward (as a basis from the need to learn the science ideas which are intended to follow and for which the students have been positively motivated).
- Outline the problem solving for which the data logging equipment is needed.

- Demonstrate the manner in which data logging equipment can be incorporated in a motivational fashion to solve the scientific problem posed.
- Readdress the socio-scientific issue by means of which the gained science learning can be consolidated by being transferred to a reconsideration of the scenario issue.
- Discussing teaching in such an approach in school and the advantages of using data logging equipment.

Presentation 4. Use of Microscale Equipment in Promoting Inquiry– based Science Education

*Miia Rannikmae, University of Tartu; Chair, ICASE Standing Committee on University
Links*

Abstract

Teachers don't have common understanding about Inquiry based science teaching - there is a myth that inquiry teaching is only linked with open experimentation which takes much teaching time and, due to the lack of equipment, often becomes impossible. Introducing the use of micro-scale equipment among teachers helps to overcome the above mentioned problems and move towards experiencing different types of inquiry in the classroom and considering students' differences in the same classroom. Three different types of inquiry based instructions will be introduced and the advantages – disadvantages discussed.

Micro-scale science equipment is one of the alternative type of equipment teachers can use in teaching science. This gives, to teachers, flexibility to choose between classroom and laboratory, to carry out experiments which demand special apparatus which might not be available at a macro-scale level and definitely economise on the amount of chemicals used. From the students' point of view, handling micro-scale equipment keeps them carefully involved and gives a feeling like they are involved in real science experimentation- not only in pure science laboratory, but also in criminalistics, medicine, industry, technological planning, etc. Bringing real life contexts and real life related experimentation into science classroom is raising students' motivation to learn science. The types of inquiry instructions can be used as models of laboratory activities given to different personnel: technicians (structured inquiry), researchers (guided inquiry) and senior team leaders (open inquiry)

The paper introduces relevant scenario for students - how can we avoid industrial air pollution in our living area. Many countries are facing the problem where economically, well operating industry is polluting the landscape and affecting the quality of life of inhabitants. We introduce 3 different teaching scenarios and show how to move from simple task towards more complex planning, experimentation and solutions.

ICASE SYMPOSIUM 2 – A set of 4 papers under one title

Promoting Primary Level STEM education

Jack Holbrook, ICASE Immediate Past President, Bulent Cavas, Chair of the ICASE Standing Committee on Publications, Steven Sexton, Chair of ICASE Pre-secondary Science standing committee and Janchai Yingprayoon, Chair of ICASE Science Centres

Overall Abstract

Primary education is undergoing major restructuring as its importance is being recognized worldwide. No longer is it viewed as nature study or environmental studies, but an important base for the study of science education at higher levels within the school. Nor is it viewed as ‘watered-down’ secondary science, based on a topic approach using unfamiliar science conceptual titles such as forces, pressure, states of matter of biological systems. Rather science at the pre-secondary level (referring to grades 1-5/6) takes on a perspective of its own drawing heavily on the teacher’s (and students’) everyday life experiences and allowing students to gain a sense of exploration, discovery and an appreciation of the place of science in their society.

In suggesting the above considerations, this symposium explores primary science from a number of perspectives

1. The need for primary science – its purpose and goals
2. Exploring the ‘wow’ the what and the why in primary science
3. Building on the popularisation of science
4. Introducing engineering in the science curriculum

These perspectives overlap, but provide a platform for ICASE to share developments at the primary level around the world.

Presentation 1 The need for primary science – its purpose and goals

Bulent Cavas, Dokuz Eylul Universitesi; ICASE Chair of the ICASE Standing Committee for Publications

Abstract

This presentation introduces approaches to the training of primary science teachers based on a revised Turkish curriculum. The emphasis is on a more hands-on approach while introducing modern technology especially related to the use of the internet.

Presentation 2 Exploring the ‘wow’, the what and the why in primary science

Stephen Sexton, University of Waikato; Chair ICASE Standing Committee for Pre-secondary science education

Abstract

An introduction to the teaching of primary science taking examples from the ICASE website and the ICASE newsletter.

Presentation 3 Building on the popularisation of science

Janchai Yingprayoon, Chair ICASE standing committee for ICASE Science Education Centres

Abstract

There are several out-of-school science activities which can be used for the popularization of science at all levels. Some of them are science project, science camp, science show or even science homework. Appropriate activities can be found to stimulate intellectual curiosity, to develop problem solving and thinking skills as well as to develop creativity. The following activities are 5 example activities that we used successfully for such learning.

- Low-cost and effective pocket microscope and a micro-projector using a laser beam
- Science activities using a laser pointer

- Applications of Ultraviolet LED for environment study
- Low-cost water battery for sustainable energy activities
- Low-cost home-made radioactivity detector

Each of these areas are explored with examples and discussed in the context of within school learning for promoted student motivation at the primary level;

Presentation 4 Introducing Engineering in the Primary Science

Curriculum

Jack Holbrook, ICASE Past President

Abstract

Based on a European project called ENGINEER, this presentation introduces an engineering cycle approach into primary science and building on this, to explore the teaching of science through an engineering approach. While the science is conceptual and thus the theoretical underpinning for the learning, the engineering component is presented as a challenge for the students and involves students in the actual construction of an artifact as the result of the challenge put forward. This presentation explores one example of such an approach making use of the science concept of floating and sinking and introducing the idea of constructing a floating raft at the grade 3-4 level. Ideas for a teacher's guide to accompany the student guidelines are put forward.

ICASE 3 A Symposium on the conference theme

Live Science – Love Learning – Create Change (CASE PROFILES)

This symposium is geared to initiating and promoting a project being conceived by ICASE that addresses the need for students in school science lessons (or labelled biology, chemistry, physics, etc). to ‘Live Science’, ‘Love Learning’ and thus being promoted by the teacher ‘creating change’ in the philosophy, approach and emphasis in science teaching and learning.

The project builds on the premise that science education is of concern and has caused an image of being irrelevant to the lives of students, is not interesting for students in promoting science-related careers, is too abstract to enable students to relate to proposed learning to the needs of everyday life and responsible citizenry and the general approach to student learning is boring, being heavily driven by textbooks which pay scant attention to the skills, attitudes and values of importance in today’s education.

The symposium sets out to address:

Live science from two major perspectives

- (a) Live (where the ‘I’ in this word is pronounced heavily) to promote hands-on experiences in a meaningful thought provoking environment, and
- (b) Live (where the ‘I’ is softly pronounced) to see the motivational importance of promoting science learning in a social or familiar frame.

This involves two project considerations

- (i) Identifying the meaning of, and the teaching approach to, inquiry-based problem solving in acquiring scientific knowledge and skills.
- (ii) Initially the teaching in a familiar issue-based setting thus promoting students’ intrinsic motivation for participating and thus learning through science lessons.

Love Science

This is addressed in terms of ‘wanting to’ participate by ensuring student appreciation of the learning proposed and its relevance to their future lives (further education, careers and developing responsible citizen attributes) in terms of VASK

Create change

This is a specific goal of the project seen particularly in terms of teacher beliefs, learning goals paying strong attention to the development of capacities rather than abilities and address competence related to VASK.

The symposium addresses the live science, love learning, create change through 2 presentations

1. The PROFILES project Jack Holbrook and others
2. The ESTABLISH project Miia Rannikmae and others

1. Abstract

The PROFILES project promotes IBSE through raising the self-efficacy of science teachers and in so doing aiding a better understanding of the changing purpose of teaching science in schools and the value of stakeholder networking. The project innovation is in utilizing existing science teaching materials to support teachers, through an inspired, longitudinal training programme reflecting stakeholder views and needs, while simultaneously promoting a reflective IBSE school-based, training related, intervention to promote learning through creative, scientific problem solving and socio-scientific decision making procedures. The measures of success are through

- a) determining the self-efficacy of science teachers in teaching innovative science education approaches allowing student acquisition of life skill competencies and
- b) in the attitudes of students toward this more context-led, student centred, IBSE emphasised learning. Dissemination of approaches, reactions, and reflections form a further key project target.

Initially PROFILES involves the development of lead teachers on four fronts (teacher as learner, as teacher, as reflective practitioner and as leader) consolidating their ownership of the context-led approach and incorporating use-inspired research, evaluative methods and stakeholder networking. The project enhances its dissemination approaches with lead teachers spearheading training of further teachers at pre- and in-service levels and initiating workshops for key stakeholders nationwide. The project focuses on the secondary level so that ‘open inquiry approaches’ are a major teaching target.

PROFILE pays much attention to student motivation for the learning of science both in terms of intrinsic motivation (relevance, meaningful, as considered by the students) and extrinsic motivation (teacher encouragement and reinforcement) and attempts to make school science teaching more meaningful by paying attention to cultural differences, esp. at the gender level

2. Abstract

The ESTABLISH project encourages and promotes the more widespread use of Inquiry-Based Science Education (IBSE) in secondary level schools, culturally adapted for each country.

The rationale for ESTABLISH lies in creating authentic learning environments for science by bringing together and involving all relevant stakeholders, particularly the scientific industrial community, policy makers, parents, science education researchers and teachers to drive change in the classroom.

Innovation in classroom practice is achieved through the involvement of stakeholders for the development and provision of:

- Appropriate teaching and learning IBSE units (informed by scientific and industrial communities)
- Appropriate supports for both in-service and pre-service teachers to implement IBSE

The outcomes of **ESTABLISH** are seen as:

- a large team of science teachers across Europe who are skilled and confident in inquiry based science teaching methodology;
- identification of suitable model(s) of science teacher education, at both pre- and in-service levels, for inquiry based science teaching;
- promotion of inquiry in the classroom, involving the relevant stakeholders in science and science education.