**THE EIGHTEENTH ANNUAL SCIENCE AND MATHEMATICS EDUCATORS CONFERENCE (SMEC 18)**

# SMEC 18

# Conference Proceedings

Science and Mathematics Education Center (SMEC)
Department of Education
Faculty of Arts and Sciences
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*We do apologize for any significant omissions.*

# SMEC 18 MISSION STATEMENT

The SMEC Conference is an annual event designed to promote the continued development of a professional community of mathematics and science educators across Lebanon and throughout the region. Specifically, the conference aims to:

- Provide an intellectual and professional forum for teachers to exchange theoretical and practical ideas regarding the teaching and learning of mathematics and science at the elementary, intermediate, and secondary levels

- Provide a forum for teacher educators and researchers to share their findings with science and mathematics teachers with a special emphasis on the practical classroom implications of their findings

- Provide an opportunity for science and mathematics teachers to interact with high-caliber science and mathematics education professionals from abroad

- Contribute to the ongoing development of a professional culture of science and mathematics teaching at the school level in Lebanon and in the region

- Raise awareness of science and mathematics teachers about the array of curriculum and supplemental classroom materials available to them through publishers and local distributors

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## PLENARY SESSION 1 - SCIENCE

### Responsive Teaching in Science: Implications for Teaching and Teacher education

***(Only abstract included for the following session)***

*Dr. Daniel Levin, University of Maryland, College Park*

An emerging area of research in science education supports pedagogical approaches that are responsive to students' ideas and reasoning. Recent science education reform documents in the United States call for teachers to shape instruction in response to students' ideas while integrating key concepts and principles and scientific practices. In this talk, I will review the emerging field of responsive teaching and synthesize existing research to describe the state of the field, using examples from classroom discourse in K-12 science classrooms. Fundamentally, I wish to address what responsive teaching means for teachers and teacher education. How can teachers develop their responsive practice? How can teacher education and ongoing professional development support responsive teaching? What are the constraints of institutional systems in schooling, and what are affordances than can be leveraged to create responsive science classrooms? I hope to engage the group in a discussion about these important questions.

## PLENARY SESSION 2 - MATHEMATICS

### Key Teacher Practices that Enhance Students' Mathematical Thinking and Learning

***(Only abstract included for the following session)***

*Dr. Marjorie Henningsen, Grey Matters Education*

In the era of reform in mathematics education, the teacher's role has commonly been described as a *'facilitator of student learning'* as a means of contrasting it with the more didactic role played by the teacher in the traditional transmission model of teaching. In this talk, I will try to unpack what it really means to facilitate student learning by highlighting several specific key teaching practices that have been identified by classroom researchers during the three decades as having a high positive impact on students' mathematical thinking and learning in school.

# RESEARCH SESSIONS

## Investigating The Influence of Pre-service Teachers' Problem-Solving Knowledge on Their Students' Problem-Solving Abilities

*Mohamed Ali Ahmed Shahat, Aswan University, Egypt & Hans E. Fischer, University Duisburg-Essen, Germany*

The aim of the proposed study is to assess the impact of pre-service physics teachers' training on problem solving on their students' problem-solving abilities. Two instruments were developed. The survey for pre-service physics teachers focused on problem-solving approaches in general, whereas the test of problem solving for tenth-grade physics students is related to Newton's laws of motion in particular, which are already included in the secondary school physics curriculum in Egypt. The instrument items were adapted from and developed based on recent studies in problem solving and English versions of the international studies. Both instruments were translated into Arabic with stringent quality control of the translation process. To determine the quality of the two instruments, a pilot study was conducted with 13 pre-service physics teachers and 42 tenth-grade students in Egypt. The sample size was limited by conditions set by the administration of the Ministry of Education and Aswan University. Data were analyzed according to the classical test theory. The findings of the pilot study demonstrated that the reliability and the internal consistency of the instruments are acceptable. This study shows how test instruments in an international study can be successfully developed, and applied to a study in Egypt. The instruments will be used in an intervention study with pre-post-assessment to evaluate the influence of pre-service physics teachers' problem-solving approaches on their tenth-grade students' problem-solving abilities. The development of the instruments, the results of the piloting, and the prospect on the planned intervention will be reported in this presentation.

*Theoretical Background:* It is now recognized that higher-order cognitive processes, such as problem solving, must be developed as learning goals for both teaching in schools and at universities, especially in the field of science education. As a result, schools are being encouraged to focus on higher-order cognitive processes in science lessons and the general emphasis on those processes has been developed considerably (McGregor, 2007). Thus, finding strategies and approaches for developing related abilities is a matter of importance for improving achievement and learning processes. The use of problem solving in science instruction implies a change of the teacher's role from dispensing content information to encouraging critical reflective thinking in the student (Chin, Goh, Chia, Lee, & Soh, 1994). Increasingly, professional education programs recognize the need for professionals to be able to solve ill-structured problems and are incorporating instructional experiences into their curricula to help students develop problem-solving abilities for further teaching at school.

The Third International Mathematics and Science Study (TIMSS) of 2007 found out that eighth- grade students in Egypt scored significantly lower than the TIMSS average. As a result, Egypt ranked 41st among the 59 participating countries (Martin, Mullis, & Foy, 2008). In addition,

the Global Competitiveness Report for 2015-2016 (Schwab, 2015) placed Egypt again below the average (96th among the 140 participating countries) in regards to the quality of primary education in general. Some studies have suggested that low student achievement is assumed to be a result of student effort, social context and the role of teachers in schools are necessary conditions of students' outcomes (see, for example, Heck, 2009) but there are also studies that consider that the deep structure of lessons is a necessary and sufficient condition for the quality of instruction (cf. Fischer, Labudde, Neumann, & Viiri, 2014).

Research on teaching and learning provides broad evidence that learning and interest-development are more effective when a student is actively engaged in the learning process rather than attempting to receive knowledge (e.g., Selçuk, Sahin, & Açıkgöz, 2011). Thus, the study presented here investigated whether pre-service physics teachers' training based on an established model for problem solving, has an impact on students' problem-solving abilities. Consequently, instruments for assessing problem-solving abilities are needed. The instruments in this proposed study were developed and adapted based on an established model of problem solving (Shahat, Ohle, Treagust, & Fischer, 2013) for assessing pre-service physics teachers' and tenth-grade physics students' abilities in Egypt. The model of problem solving (Shahat et al., 2013) encourages students to follow an eight-stage process identifying and formulating the problem, activating pre-knowledge related to the problem, defining and representing the problem, formulating an expected result (hypotheses), exploring a possible way of solving the problem (variable discrimination), performing the solving process, fixing data and calculating, and finally, looking back to the idea (hypotheses) and evaluating.

*Aims and Research Questions*: The overarching goal of this study is to assess the impact of pre-service teachers' problem-solving knowledge on their students' problem-solving abilities. Therefore, instruments that can reliably and validly measure student outcomes under Egyptian conditions are needed. As a first step, it is planned to construct the instruments by adapting German and English instruments by taking into consideration the cultural differences and peculiarities of German, English and Arabic languages. The following aims are addressed: 1) Identifying the processes of problem solving, 2) developing two paper-and-pencil instruments for assessing the Egyptian pre-service physics teachers' and tenth-grade physics students' knowledge on problem solving, 3) validating the constructed paper-and-pencil tests, 4) training of pre-service teachers on problem solving 5) using the tests to assess the Egyptian pre-service physics teachers' and tenth-grade physics students' knowledge on problem solving at school in an intervention study with a pre-post control-group design. The leading research questions in this study are:

1. What is the effect of problem-solving training based on a model of problem solving on pre-service teachers' problem-solving abilities?
2. What is the effect of the teacher training on their students' problem-solving abilities?

Accordingly, the following research hypotheses are developed:

1. H.1. For pre-service physics teachers: There are differences between the control group and intervention group regarding the increase of problem-solving approaches. The pre-service physics teachers in the intervention group will perform significantly better.

2. H.2. For tenth-grade students: There are differences between the control group and intervention group regarding the increase in their problem-solving abilities. The students in the intervention group will perform significantly better.

**Methodology**

*Participants and Settings:* Pre-service teachers in Egypt are the undergraduate students in faculties of education at universities who have teaching practice in their third and fourth years. The sample of pre-service physics teachers will be non-randomly selected for this study from the fourth year of studies at the Faculty of Education, Aswan University. Students at the tenth-grade level, who are 15 years old, will be selected because this level is the first year of the Egyptian secondary school stage and problem solving is one important part of the curriculum of this grade. In order to control the content, to enlarge the variance and to enable the use of the developed instruments, the study focuses on a limited area of one topic, namely, Newton's laws of motion. Students tend to have difficulties learning about this topic (e.g., Waldrip, Prain, & Sellings, 2013). The new model of problem solving will be used to train students in the Faculty of Education of Aswan University in an intervention study. The research design is quasi experimental because the sample of pre-service physics teachers cannot be randomly chosen; this is because at present it is not known how many students will agree to participate in the study, therefore, performing a case study will be one option. If more than 15 pre-service physics teachers in the intervention and the same number in the control group are available, some statistically evident results can be expected. An intervention study for tenth-grade students will be also conducted in a quasi-experimental design with pre- and post-assessment in two secondary schools. The intervention group will be taught by the pre-service physics teachers who will have training on problem-solving instruction, whereas the control group will be taught by pre-service physics teachers without such training.

*Instruments*[1]*:* Qualitative and quantitative research methods will be used in this study in which two new instruments were adapted and developed. The items of the two instruments—Problem Solving Approaches Survey (PSAS) and Problem Solving Test (PST)—were developed based on recent studies on problem solving and other international student assessment studies (TIMSS and PISA). The tests items were constructed on the basis of a model of problem-solving processes. Problem solving in this study is defined as an individual's capacity to use different cognitive activities in cross-disciplinary situations where the solution path is not obvious and where the content areas or curricular areas that might be applicable are within a single subject area of science. Based on this definition, this study assumes that in a problem-solving situation, the pre-service physics teacher or the student ideally and typically knows the solution, but he or she does not know how to reach it (Oser & Baeriswyl, 2001). In the Problem Solving Approaches Survey (PSAS), pre-service physics teachers have to rate a list of given action alternatives with a scale from strongly agree to strongly disagree, whereas in the Problem Solving Test (PST), students have to answer open-ended questions. Content validity is taken into account by comparing the instruments and the curricula. The content of the instruments is a proper subset of the related curricula of the Faculty of Education and the secondary school. To improve the content correctness and to ensure the validity of the instruments' items, the authors took into account the opinions of experts: five postdoctoral students and three in-service physics teachers, all of whom specialized in physics education in Germany or Egypt, and each of whom received a copy of the two instruments and reviewed their items—according to the study's definition of problem solving and commented on a checklist

[1] The presentation will show some examples of the instruments' items.

related the correctness of the items. Modifications were then made to the items based on the comments provided by these experts. After the construction of these two paper-and-pencil instruments in English, the instruments were translated into Arabic with stringent quality control of the translation process including back translation. Based on the unique characteristics of the education systems of developed countries and Egypt, language and cultural differences were carefully taken into consideration to ensure the comparability of the data. Tenth-grade students' responses to the problem-solving test were coded by two independent coders at the Faculty of Education, Aswan University. The inter-rater agreement of the two coders was acceptable (Cohen's kappa = .71) (e.g., Elliott & Woodward, 2006).

*Data Analysis:* To evaluate the inter-rater agreement between evaluators' rating, a Cohen's kappa (κ) was used. For estimating the quality of instruments, data were analyzed by using the classical test theory. According to the classical test theory, internal consistency of a scale measured in Cronbach's Alpha should be greater than .70 and a discriminatory power of items greater than .30 is an acceptable value (Wendler & Walker, 2006). The item difficulty in this study was measured by the percentage of students who answer an item correctly. Accordingly, the correct solution frequency was estimated. Accepted average of the correct solution rate of an item ranged from about 20 to 80% (see Bühner, 2004). IBM SPSS Statistics Version 19 was used for processing the data classically. Relevant students' characteristics such as age, gender, prior knowledge, cognitive abilities, social background, and interest will be controlled for. In addition, teacher's characteristics and classroom settings like classroom management, duration of instruction, and job experience will be also controlled for. To answer the two research questions of the study, *t*-test for independent samples and multi-level analyses will be used to evaluate the impact of problem-solving instruction on pre-service physics teachers' problem-solving approaches and tenth-grade students' problem-solving abilities (Field, 2009).

**Preliminary Results**[2]

From October to November 2015, a pilot study was conducted on a sample of 13 pre-service teachers and 42 tenth-grade students. The quality criteria were tested, as shown in Table 1, for the Problem Solving Approaches Survey (PSAS) and the Problem Solving Abilities Test (PST) according to the classical test theory.

Table 1. Descriptive statistics and Cronbach's Alpha coefficient of instruments

| Instrument | No. of respondents | No. of accepted items* | No. of excluded items | Mean | SD | Cronbach's alpha (α) |
|---|---|---|---|---|---|---|
| PSAS | 13 | 35 | 3 | 86.02 | 14.10 | .72 |
| PST | 42 | 11 | 1 | 06.70 | 01.34 | .68 |

* Discriminatory power > .3

In the Problem Solving Approaches Survey (PSAS), three items showed negative correlation with the other items and unsatisfactory discriminatory power and were therefore excluded. The internal consistency of the remaining items could be confirmed with a Cronbach Alpha value of .72 (for 35 items; discriminatory power > .3). For the Problem Solving Test (PST), the internal consistency of items could be confirmed with an Alpha value of .68 (for 11 items; discriminatory power > .3). One

[2] The presentation will show more details about all the results.

item showed unsatisfactory discriminatory power and was therefore excluded. The slightly low reliability result for PST was acceptable due to the small sample size in the pilot study.

## Discussion and Implications for Practice

One theoretical advancement of the present study is that two problem-solving tests were developed for assessing pre-service physics teachers' and tenth-grade physics students' knowledge on problem solving. These instruments were developed and adapted to the situations of science education in Egypt (e.g., pre-service physics teachers, secondary schools grades), and according to the proposed model of problem solving, recently conducted studies on problem solving and the school conditions in Egypt. Overall, the results of the pilot study showed that even with this small sample size, these instruments were found to have acceptable reliability and internal consistency and that they could be effectively designed for use in schools in Egypt. In addition, pre-service physics teachers and tenth-grade students showed a moderate solution rate of 49% and 47% in problem-solving approaches and problem-solving abilities respectively. We expect that the results of the main study will provide an overview about the physics problem-solving knowledge of pre-service teachers in Egypt. The resulting instruments can also be used to assess the pre-service physics teachers' pre-knowledge on problem solving before they become in-service physics teachers at school and to rank Egyptian students' performance on problem solving as a baseline. Moreover, the Problem Solving Test could very well be useful for further research on other science topics by using its structure and by changing the topic accordingly. In addition, the Problem Solving Approaches Survey can also be used for further research on in-service physics teachers in secondary schools. Another contribution of this study is that it will show how test instruments can be successfully developed and adapted from one study to another by taking into consideration the differences in language and culture across countries. Furthermore, these instruments will be used for investigating the influence of pre-service teachers' problem-solving knowledge on their students' problem-solving abilities in an intervention study with a pre-post design. Accordingly, as a next step, the developed instruments will be used to evaluate an intervention—based on a model for problem solving that will start in October 2016—aiming to foster pre-service physics teachers' problem-solving approaches and tenth-grade students' problem solving abilities in Egyptian physics classes. This model can be used for further research for developing other lesson plans in various topics at different school stages and for verifying its effect on students' outcomes. The study may also help and guide in-service teachers and teacher educators on how to implement problem-solving situations in classroom instruction, about which there have been high expectations internationally and also in developing countries like Egypt.

## References


Bühner, M. (2004). *Einführung in die Test- und Fragebogenkonstruktion* [Introduction to test- and questionnaire development]. München: Pearson.

Chin, C., Goh, N.-K., Chia, L.-S., Lee, K.-W., & Soh, K.-C. (1994). Pre-service teachers' use of problem-solving in primary science. *Research in Science Education*, *24*(1), 41–50.

Elliott, A. C., & Woodward, W. A. (2006). *Statistical analysis quick reference guidebook: With SPSS examples*. London: SAGE.

Field, A. P. (2009). *Discovering statistics using SPSS* (3rd ed.). London: SAGE Publications Inc.

Fischer, H. E., Labudde, P., Neumann, K., & Viiri, J. (Eds.). (2014). *Quality of instruction in physics: Comparing Finland, Germany and Switzerland*. Münster, Westf: Waxmann.

Heck, R. H. (2009). Teacher effectiveness and student achievement. *Journal of Educational Administration*, *47*(2), 227–249.

Martin, M. O., Mullis, I. V., & Foy, P. (2008). *TIMSS 2007: International science report: findings from IEA's Trends in International Mathematics and Science Study at the fourth and eighth grades*. Boston, MA: IEA TIMSS & PIRLS.
McGregor, D. (2007). *Developing thinking, developing learning: A guide to thinking skills in education*. Maidenhead: Open University Press.
Oser, F. K., & Baeriswyl, F. J. (2001). Choreographies of teaching: Bridging instruction to learning. In V. Richardson (Ed.), *Handbook of research on teaching* (4th ed.) (pp. 1031–1065). Washington, D.C.: American Educational Research Association.
Roderick, M., & Engel, M. (2001). The grasshopper and the ant: Motivational responses of low-achieving students to high-stakes testing. *Educational Evaluation and Policy Analysis, 23*(3), 197–227.
Schwab, K. (2015). *The global competitiveness report 2015-2016*. Geneva: World Economic Forum.
Sezgin Selçuk, G., Sahin, M., & Açıkgöz, K. Ü. (2011). The effects of learning strategy instruction on achievement, attitude, and achievement motivation in a physics course. *Research in Science Education, 41*(1), 39–62.
Shahat, M. A., Ohle, A., Treagust, D. F., & Fischer, H. E. (2013). Design, development and validation of a model of problem solving for Egyptian science classes. *International Journal of Science and Mathematics Education, 11*(5), 1157–1181.
Waldrip, B., Prain, V., & Sellings, P. (2013). Explaining Newton's laws of motion: Using student reasoning through representations to develop conceptual understanding. *Instructional Science, 41*(1), 165–189.
Wendler, C., & Walker, M. E. (2006). Practical issues in designing and maintaining multiple test forms for large-scale programs. In S. M. Downing & T. Haladyna (Eds.), *Handbook of test development* (pp. 445–467). Mahwah, NJ: Lawrence Erlbaum Associates.

**دراسة مقارنة بين التدريس التفاعلي والتدريس التقليدي لوحدة درس الحركة للصف السادس المتوسط (بنين)**

*فاطمة الهاشم، المركز الوطني لتطوير التعليم، الكويت، أنور محمد، كلية التربية الأساسية، الكويت*

**ملخص الدراسة**

هدفت الدِّراسة إلى معرفة أثر التدريس التفاعلي في التحصيل الدِّراسي وبقاء أثر التعلم لدى طلاب الصف السادس في مادة العلوم (وحدة الحركة)، ولتحقيق أهداف الدِّراسة استخدم الباحث اختبار تحصيلي، طبقت على عينة مكونة من (75) طالباً من طلاب الصف السادس ، وزعت على مجموعتين: ضابطة وتجريبية، وقد أظهرت نتائج الدِّراسة فروقا ذات دلالة إحصائية بين متوسطي درجات طلبة المجموعتين التجريبية والضابطة في الاختبار التحصيلي البعدي، لصالح طلبة المجموعة التجريبية وأوصت الدِّراسة بضرورة تدريس مادة العلوم بطريقة التدريس التفاعلي لما لها أثر ايجابي في تحصيل الطالب.

**خلفية عن الدراسة**

أشارت الدراسات الحديثة على أهمية التدريس التفاعلي على زيادة الكفاءة العلمية التربوية للطالب. و قد أخذ التدريس التفاعلي أشكالا و أنماطا متعددة و خصوصا مع ثورة التكنولوجيا و المعلومات التي أصبحت عاملا مهما جدا في تطور التدريس التفاعلي. التدريس التفاعلي غير الشكل التقليدي للدراسة بحيث أصبح محور العملية التدريسية الطالب و ليس المعلم. و في ظل التحديات على أرض الواقع لا يزال التدريس التقليدي منتشر في صفوف الدراسة و خصوصا في مادة حيوية كمادة العلوم و التي تعتمد بشكل مباشر على التجربة و الملاحظة و الاستنتاج و صقل مهارات الطالب العلمية و العملية.
بات اليوم المعلم قادرا على تحقيق التدريس التفاعلي من خلال استخدام التكنولوجيا كأجهزة الحاسب الآلي و الآيباد و غيرها من الوسائل التكنولوجية و التي تساعد المعلم في ايصال المعلومة للطالب بصورة جذابة و تفاعلية بوقت و جهد أقل. و تترتب على الطريقة التفاعلية في التدريس تحسين الأداء عند المعلم و المتعلم معا.

أبعاد التدريس الفعال

يقوم التدريس الفعال على بعدين هما :

البعد الأول : الإثارة الفكرية : وهي تعتمد على مهارة المدرس وتتمثل في :

وضوح الاتصال الكلامي مع المتعلمين عند شرح المادة العلمية .

أثر المدرس الانفعالي الإيجابي على المتعلمين ويتولد هذا من طريقة عرض المادة العلمية .

البعد الثاني :الصلة الإيجابية بين المدرس والتلاميذ : لابد أن يعمل المعلم على تحسين مهارة الاتصال مع التلاميذ وذلك لزيادة دافعيتهم للتعلم ويمكن أن يتحقق ذلك بإحدى الطريقتين التاليتين

تجنب استثارة العواطف السلبية عند التلاميذ ، مثل القلق الزائد أو الغضب .

تطوير عواطف إيجابية عند التلاميذ مثل احترامهم وإثابة أدائهم الجيد

اهداف التعلم التفاعلي :

يرى كل من سعادة(2006م ،ص33-38) وجبران(2003م،ص10) والخليلى واخرون (2004م،ص144-146) ان اهداف التعلم التفاعلى تتمثل فى التالى:

تشجيع الطلبة على طرح الاسئلة المختلفة.

تمكين الطلبة من اكتساب مهارات التعاون والتفاعل والتواصل مع الاخرون.

زيادة الاعمال الابداعية لدى الطلبة وتمكينهم من العمل بشكل ابداعى.

اكتساب الطلبة للمعارف والمهارات والاتجاهات المرغوب فيها.

تشجيع الطلبة على اكتساب مهارات التفكير العليا( التحليل ، والتركيب ، والتقويم) ومهارات حل المشكلات ، وتمكينهم من تطبيقها فى التعلم والحياة.

أبرز فوائد التعلم التفاعل

تشكل معارف المتعلمين السابقة خلال التعلم التفاعلى دليلا عند تعلم المعارف الجديدة ، و هذا يتفق مع فهمنا بأن استثارة المعارف شرط ضروري للتعلم.

يتوصل المتعلمون خلال التعلم التفاعلى إلى حلول ذات معنى عندهم للمشكلات لأنهم يربطون المعارف الجديدة أو الحلول بأفكار و إجراءات مألوفة عندهم و ليس استخدام حلول أشخاص آخرين.

يحصل المتعلمون خلال التعلم التفاعلى على تعزيزات كافية حول فهمهم للمعارف الجديدة.

يبين التعلم التفاعلى للمتعلمين قدرتهم على التعلم بدون مساعدة سلطة ، و هذا يعزز ثقتهم بذواتهم و الاعتماد على الذات.

يساعد التعلم التفاعلى على تغيير صورة المعلم بأنه المصدر الوحيد للمعرفة ، و هذا له تضمين هام في النمو المعرفي المتعلق بفهم طبيعة الحقيقة.

النتائج الايجابية للتعلم التفاعلى : اورد جبران(2002م،ص20) وجودمان( (Goodman,s1998,p.3)النتائج الايجابية للتعلم التفاعلى وهى :

1.بقاء اثر التعلم لدى المتعلم :حيث اظهرت العديد من البحوث ان نسبة احتفاظ (استبقاء) الطلبة للمعرفة واتقان مهارات التفكير العليا وتبنى اتجاهات ايجابية ودافعية اكبر للتعلم فى المستقبل فى التعلم التقليدى تكون محددة،بينما تكون هذه النسبة اعلى بكثير فى التعلم التفاعلى.

2.زيادة التفاعل داخل الفصل : اشار غازى(2004م،ص66) ما ذكره جابر وهالة طليمات ان الطلاب عندما يندمجون فى الانشطة التعليمية الصفية نلاحظ انهم يستجيبون للأنشطة بطرق مختلفة ؛وذلك وفقا لتنوع ميولهم.

3.تطوير اتجاهات ايجابية نحو المادة التعليمية :حيث يبدأ الطلاب فى تقبل المسئولية الشخصية عن التعلم،ويقومون بأعمال وأنشطة تساعدهم على التمكن من المحتوى، بالاضافة الى التمكن من الادارة الذاتية لاعمالهم ،ويؤدى التعلم التفاعلى الى زيادة دافعية الطلبة للتعلم ،وهذا يقود الى تطوير اتجاهات ايجابية لدى الطلبة نحو المادة التعليمية.

4.زيادة تحصيل الطلبة : ذكر فوكس وريو((Fox-Gardamone&Rue,2003,p.4 التأثير الايجابى للتعلم التفاعلى على الطلبة،والذى يتمثل فى عدة جوانب منها: زيادة دافعيتهم للتعلم، وانتباههم وتطوير اتجاهات ايجابية نحو المعلم والمادة

**سؤال الدراسة :**

ما هو أثر التدريس التفاعلي على طلبة الصف السادس لوحدة الحركة؟ و ما هو الفرق في الدلالات احصائية على التحصيل العلمي لصف تم تدريسة بطريقة تفاعلية و اخرى تقليدية؟

**وتتحدد مبررات الدِّراسة الحالية بما يلي:**

ما أشارت إليه العديد من الدراسات و أحدها دراسة تيمز TIMSS بضعف تحصيل الطلبة في مادة العلوم في التعليم العام بدولة الكويت. بضرورة توظيف المستحدثات من وسائل التدريس في رفع مستوى الطالب و تفكيره العلمي الناقد و الذي يعتمد على تحفيز الطالب للتساؤل و التجريب بدلا من التلقين في مادة العلوم.

**مشكلة الدِّراسة:**

تتمثل مشكلة الدِّراسة في السؤال الرئيس الآتي:

ما أثر استخدام التدريس التفاعلي في التحصيل الدِّراسي على وحدة الحركة وبقاء أثر التعلم لدى طلاب الصف السادس في مادة العلوم؟

**فروض البحث:**

لا توجد فروق ذات دلالة إحصائيةً بين متوسطات درجات الطلاب في المجموعة التجريبية الذين يدرسون مادة العلوم وحدة الحركة عن طريق التدريس التفاعلي، ومتوسطات درجات الطلاب في المجموعة الضابطة والذين يدرسون مادة العلوم وحدة الحركة بالطريقة الاعتيادية في التطبيق البعدي.

**أهداف الدِّراسة:**

تهدف الدِّراسة الحالية إلى معرفة أثر التدريس التفاعلي في التحصيل الدِّراسي، وبقاء أثر التعلم لدى طلاب الصف السادس في مادة العلوم "وحدة الحركة"

**أهمية الدِّراسة :**

تكمن أهمية هذه الدِّراسة في أنها:

تسليط الضوء على التدريس التفاعلي في مادة العلوم في التحصيل الدِّراسي للمتعلمين، وبقاء أثر التعلم.

قد تفيد معلمي العلوم في تطوير طرائق وأساليب التدريس والتقويم لديهم.

قد تفتح الدِّراسة الحالية آفاقا جديدة لدى الباحثين لإجراء دراسات مستقبلية في استخدام مستحدثات تكنولوجية جديدة في العملية التعليمية في مراحل تدريسية مختلفة، ومواد دراسية متنوعة.

**حدود الدراسة**

اقتصرت العينة على مدارس البنين للمرحلة المتوسطة

ثلاثة فصول 75 طالب في الصف السادس .

**منهجية الدراسة**

اعتمدت الدارسة على المنهج الوصفي و التحليلي.

**منهـج الدِّراسة :**

استخدم الباحثان في هذه الدِّراسة المنهج شبه التجريبي ، وذلك باستخدام مجموعتين: الأولى تجريبية تم تدريسها بطريقة تفاعلية باستخدام الايباد و وسائل تكنولوجية مختلفة، والثانية ضابطة تدرس بالطريقة الاعتيادية.

وتتمثل الخطوات الدراسة في النقاط التالية:

- تم إعداد اختبار تحصيلي لوحدة الحركة و تحكيمه لغويا و من الناحية العلمية.
- تم اختبار الفصول قبل تدريس فصل الحركة
- تم تدريس الطلبة بطريقة تفاعلية و اخرى تم تدريسها بالطريقة الاعتيادية
- تضمنت دروس التفاعلية سلسلة من التعلم التعاوني و الشرح باستخدام جهاز العرض المرئي و تطبيقات أيباد مختلفة تضمنت مفاهيم في وحدة الحركة
- تم اختبار الطلبة في نهاية وحدة الحركة و استخراج النتائج

**إعداد أدوات الدِّراسة :**

**أولاً: إعداد الاختبار التحصيلي في مادة العلوم:**

تم استخدام الاختبار التحصيلي لقياس مستوى التحصيل، وبقاء أثر التعلم لأفراد العينة في محتوى الدروس المختارة في مقرر العلوم للصف السادس.

**الهدف من الاختبار:** يهدف الاختبار التحصيلي إلى قياس مدى تحصيل طلبة الصف السادس في وحدة الحركة في مادة العلوم.

**صياغة مفردات الاختبار:** تكون الاختبار في صورته النهائية من (40) موضوعية و مقالية وكانت بعد تحكيمها سليمة من الناحية اللغوية والعلمية، ومحددة واضحة خالية من الغموض، ومنتمية لمحتوى المادة، وممثلة للأهداف، ومناسبة لمستوى الطلاب العقلي والعمري.

**صدق الاختبار :**

تم عرض الاختبار على مجموعة من المختصين بهدف التأكد من صحة صياغة المفردات علمياً، ودقة مستويات القياس، ومدى ملاءمة المفردات ، من

**النتائج**

| المقياس | المجموعة | عدد التلاميذ | المتوسط الحسابي | التفاوت |
|---|---|---|---|---|
| الاختبار القبلي | التجريبية | 25 | 3 | 3.06 |
| | التجريبية | 25 | 3.88 | 15.14 |
| | الضابطة | 25 | 2 | 3.36 |

يتضح فروق بين متوسطي درجات طلبة المجموعتين التجريبية والضابطة في الاختبار التحصيلي البعدي، لصالح طلبة المجموعة التجريبية، تشير تلك الفروق إلى أن استخدام التعليم التفاعلي يسهم في رفع مستوى أداء الطالب في وحدة الحركة بمادة العلوم مقارنة بالتدريس التقليدي.

**توصيات الدِّراسة :**

في ضوء ما توصلت إليه الدِّراسة من نتائج ، يُوصي الباحثون بالآتي:

الاهتمام بتزويد المعلمين ،أثناء الخدمة، بكافة المعارف والمهارات التي تتعلق بالمستحدثات التكنولوجية وخاصة السبورة التفاعلية واستخدامها في العملية التعليمية .

ضرورة حث المعلمين على استخدام اسلوب التدريس التفاعلي في تدريس العلوم خاصة، والمواد الدِّراسية الأخرى عامة .

تصميم بعض دروس العلوم في كافة المستويات التعليمية من المرحلة الأساسية؛ لاستخدامها في التدريس التفاعلي.

عقد دورات تدريبية للمعلمين تساعدهم في تصميم عناصر الوسائط المتعددة وإنتاجها، من صور متحركة، ونصوص مكتوبة، ورسومات، مع توفير الأجهزة المساعدة على إدخال لقطات الفيديو، والصور الثابتة، والرسومات التعليمية، وغيرها من أدوات تسهم في دروس نموذجية في كل موقف تعليمي.

**قائمة المصادر**


نحاس، محمود نديم، التعليم التفاعلي وأهميته في التعليم المستمر، مؤتمر الشراكة بين الجامعات والقطاع الخاص في البحث والتطوير، جامعة الملك سعود، الرياض، إبريل 2005. 8.

أبو جوير، أماني، " أثر استخدام برنامج حاسوبي متعدد الوسائط من خلال السبورة الإلكترونية في تدريس العلوم على التحصيل وبعض مهارات التفكير المعرفية والاتجاه نحوها لدى تلميذات المرحلة الابتدائية " (رسالة ماجستير) كلية التربية للبنات ، جامعة الأميرة نورة بنت عبد الرحمن، الرياض، 2009.

الزعبي ، شيخة، " أثر برنامج تعليمي باستخدام السبورة التفاعلية في التحصيل الدِّراسي مادة العلوم لدى تلاميذ الصف الخامس الابتدائي بدولة الكويت "، المجلة التربوية (ملخصات الرسائل الجامعية)، 2012، (102)، 399-393.

Schroeder, U. and Spannagel, C., Supporting Active Learning in ELearning Scenarios, Proceedings of the Seventh IASTED International Conference on Computers and Advanced Technology in Education, Aug 16-18 2004, Kauai, HI, United States, pp. 124-129. Published by Acta Press.

Angehrn, A., Nabeth, T., Razmerita, L. and Roda, C., K-InCA: Using Artificial Agents for Helping People to Learn New Behaviours, Proceedings of IEEE International Conference on Advanced Learning Technologies (ICALT 2001), IEEE Computer Society, August 2001, Madison

**هوية العلماء من وجهة نظر طالبات المرحلة المتوسطة ومعلماتهن دراسة تحليلية لرسومات الطالبات والمعلمات في المرحلة المتوسطة بدولة الكويت**

*فاطمة الهاشم، المركز الوطني لتطوير التعليم، الكويت*

**ملخص الدراسة**

مفهوم العلم و التعلم لا يقتصر على فرد دون آخر و إن تفاوتت القدرات فإن الإنسان مخلوق مجبول على التعلم و لكن أصبح مفهوم و لقب العالم مرتبطا ارتباط بهوية الرجل الغربي الأبيض. و قد أصبحت الصورة دارجة للكثيرين ليس للغرب وحدهم بل لكثير من الشعوب و الأمم بحيث ارتسمت شخصية تاريخية ذات نمط واحد، و قد أجرى الباحثون في الغرب عدة أبحاث في هذا المجال (مصدر) لمعرفة تصورات الطلبة لشكل العالم من خلال الرسم و تحليلها من خلال مقياس DAST. و عليه فإننا من خلال هذه الدراسة تم التطبيق على عينة من المعلمات للمواد العلمية ( العلوم – الرياضيات – التكنولوجيا) و طالبات المرحلةالمتوسطة ( الصف السادس) لمرحلة تصورات العالم في أذهانهن و تحليله من خلال المقياس نفسه. و خلصت النتائج إلى وجود صورة نمطية للعالم الغربي الأبيض المتقدم بالعمر في البداية و لكنها تغيرت بفارق كبير لدى الطالبات فقط بعد الوعي بقيت كما هي عند المعلمات. و عليه خلصت الدراسة إلى ضرورة ايجاد و خلق هوية علمية لدى طلبة و معلمي العلوم.

**خلفية عن الدراسة و دراسات سابقة**

لوحظ في السنوات الماضية انحسار الدور العربي في البحث العلمي و أصبحت الأوساط العلمية غربية بصفة سائدة مع غياب ملحوظ لشعوب أخرى أحدها الشعوب العربية و ترجع أسباب الغياب إلى عوامل و مؤثرات داخلية و خارجية. بالنسبة للعوامل الداخلية فإنها تأتي إلى غياب الرؤية لدى الأمة و انتشار الصراعات و الحروب و و عدم المبادرة أو مبادرات محدودة بشأن احداث التغيير و مواكبة الأمم الأخرى .أما العامل الثاني فإنه تولد بسبب حالة النكوس للماضي و العودة إلى التراث و رغبة الإنسان العربي بالعودة للماضي لمواكبة المستقبل و هذا بحد ذاته سبب محوري في مسألة فقدان الهوية، فأبناء الحاضر يريدون و يرغبون في و يأتي العامل الثالث و هو مرتبط بالعوامل و المؤثرات الخارجية ألا وهو ضعف و تفكك مفهوم الثقافة العلمية لدى العرب و عدم ديمومتها . أما بالنسبة للعوامل الخارجية فهي ليست وليدة اليوم إذ أن فترة الاستعمار و الهيمنة الغربية في القرن الماضي على مقدرات الدول العربية ساهمت بشكل كبير على إضعاف الصورة لدى الإنسان العربي، و لا نغفل أيضا بأن هيمنة الغرب على العلم في حقبة الثورة الصناعية في القرن الماضي أدى إلى ترسيخ مفاهيم غير صحيحة و فرض هوية على الشعوب الأخرى كشعوبنا العربية.

و لما كان دور العلوم و البحث العلمي و الثقافة العلمية مهما جدا في مسألة تحديد قوة و ضعف الأمة. و نظرا لأهمية العلم و المعرفة فإن دورهما لا يقتصر فقط على معرفة الحقائق و المفاهيم العلمية بل يتمد ذلك إلى فكر الفرد نفسه. و لا يتقصر مفهوم تدريس مادة العلوم على معرفة مادة العلوم بل يشمل أيضا العمل على خلق مفهوم الثقافة العلمية لدى الطلبة فمن أهداف تدريس العلوم العامة بدولة الكويت هو " مساعدة الطلبة في التعرف على المنجزات العلمية للعلماء العرب والمسلمين وإحترامهم وتقديرهم والتمثل بهم." و لما كان هذا هدف من أهداف تدريس مادة العلوم أراد الباحثون من خلال هذه الدراسة التعرف على تصور الطالبات لشكل العالم لدى مجموعة من الطالبات و المعلمات.

**منهجية الدراسة**

تم الاستعانه بمقياس "DAST "Draw A Scientist و الذي قام به ديفد تشامبرز في سنة 1983 ومن ثم تم تعديله في بداية التسعينات و اختبار العديد من الطلبة لمعرفة تصورهم للعالم. و علىه فقد قام الباحثون في هذه الدراسة بترجمة المقياس للغة العربية و استخدامه تم الحصول أولا على الموافقات لعمل الدراسة وتم التطبيق الأول على كل من المعلمات و الطالبات بدعوتهن لرسم عالم دون أي شرح و ذلك حتى نرى تصورات العينة لمفهوم العالم "لو تخيلت شكل عالم فما هو شكل العالم في تصوركم؟"

قامت الطالبات و المعلمات على حده برسم العلماء حسب مفهومهن. و من ثم عمل مطوية و مناقشة كل من الطالبات و المعلمات بالعلماء العرب و المسلمين في الماضي و الحاضر و أن المحيط الأقليمي الذي ينتمون إليه لا يخلو من علماء و عالمات سواء في الماضي و الحاضر. بعد مناقشتهن تم تكرار الطلب برسم تصورهن عن العلماء فكانت النتيجة مختلفة تماماو تم تحليلها و مقارنة الرسومات بحسب مقياس DAST Draw A Scientist و تحليل النتائج. تم مقارنة النتائج الأولية بالثانوية

قياس نسب الفرق من خلال البرنامج الاحصائي SPSS. لذا اعتمدت النتائج على التحليل التابين الأحادي من خلال مقارنة الرسومات للماعلمات و الطالبات قبل و بعد التوعية

**نتائج الدراسة:**

**السؤال الأول كيف تصور طالبات و معلمات المواد العلمية في المرحلة المتوسطة لشكل العلماء في مخيلتهن؟**

في بداية تطبيق الدراسة كانت الرسمات الأولى تبين شكل العالم على أنه رجل أبيض غربي كبير في السن و يلبس معطف أبيض و قد سادة تلك الصفات على أغلب الرسومات في المرة الأولى. و من ثم تم عمل حملة توعية بين المعلمات و الطالبات نشر مطويتين مختلفتين للطالبات و المعلمات عن العلماء العرب و المسلمين من الماضي و الحاضر و من ثم تم تكرار الطلب برسم العالم مرة أخرى و من ثم تم حساب الفرق بين رسومات الطالبات قبل و بعد و كذلك المعلمات .

**السؤال الثاني ما مدى تغير شكل العلماء بعد التوعية؟**

تبين أن رسومات الطالبات تغيرت في حين بقيت رسومات المعلمات تشكيل إلى نفس النمط. انخفض المتوسط الحسابي للطالبات بعد التوعية في حين بقي المتوسط الحسابي للمعلمات كما هو تقريبا. و لكن أشار تحليل أحادي التابين على وجود فارق ما بين المجموعتين ( المعلمات و الطالبات) و أن الطالبات تأثرن أكثر بالحملة التوعوية

**الخاتمة**

خلصت الدراسة إلى وجود صورة ذهنية ذات نمط غربي عن هوية العالم لدى كل من الطالبات و المعلمات و حتى بعد عمل نشاط بهدف نشر الوعي عن طريق مطوية لم يتغير المفهوم كثيرا بالنسبة للمعلمات و لكنه تغير بنسبة أكبر مقارنة بالمعلمات. لذا نتسطيع القول بأننا كتربويين مختصين في مجال العلوم نجد أنفسنا أمام إعادة خلق نظرة جديدة لصورة و نمط العالم لدى الأجيال و ذلك للحرص على خلق هوية علمية تلامس واقع الطلبة.

**التوصيات**

- وضع آلية لنشر ثقافة الهوية العلمية و تعزيزها لدى المجتمع على المستى التربوي و المستوى المجتمع من خلال إقامة معارض و تطبيقات الكترونية
- نشر ثقافة من خلال إعادة ربط المجتمع بالقراءة الحرة و للتسلية مع غرس المفاهيم بشكل غير مباشر في الكتب لتعزيز مفهوم الهوية
- ابراز جانب المرأة العربية و تعزيز وجودها في الكتب المدرسة و غيرها من وسائل المعرفة العاديةو الالكترونية و ذلك لخلق جيل يستمر على نهج النساء الناجحات من الأقليم العربي
- الاستعانة بمؤسسات الدولة و جمعيات النفع العام لإبراز الهوية العلمية المحلية و التعاون كذلك على المستوى الاقليمي لنشر و إعادة بناء هوية لها كيان علمي و ثقافي يمثل الاقليم الذي نعيش به
- الاستعانة بأبحاث مشابهة لهذا البحث و أبحاث تهتم بهوية الفرد العربي لكتابة مقترح تعاوني أقليمي يعزز مفهوم الهوية العربية العلمية و يعزز من مراكز العلوم و الثقافة العلمية

**توصيات لبحوث و دراسات في المستقبل**

- لاشك أنه لكل بحث حدود و لكن نضع توصياتنا لإجراء بحوث مستقبلية تشمل جوانب لم يشملها البحث الحالي لظروف الباحثين أو قصر الوقت أو ظهور عوامل لم يتم الأخذ بحسبتها
- تحويل الدراسة إلى استبانه لقياس مفهوم الهوية العلمية لدى شريحة كبيرة من المجتمع
- عمل دراسة مشابهة على مدارس البنين و مقارنتها بالنتائج لهذه الدراسة
- يجدر بالذكر بأن صفة المذكر على لقب علماء قد تؤثر في نتائج الرسومات و عليه يجب الشرح أو التنويه بوضع كلمة (عالمات) بجانب علماء أو على الأقل التنويه أثناء عمل دراسات مستقبلية

**قائمة المصادر**


- الجابري، محمد عابد و آخرون، (1986) الموسوعة العربية الفلسفية ( الاصطلاحات و المفاهيم) مصطلح الهوية، المجلد الأول، معهد الإنماء العربي، بيروت.
- غريب، حسن خليل، (2008)، الاختلاف حول الهوية الثقافية و الهوية القومية أزمة سياسة تعيق طريق حركة التحرر العربي، مؤتمر إشكالية الهوية في ظل العولمة ، عمان.
- مقلد، حسين طلال (2011) الهوية فوق الهوية الوطنية "الأوربية نموذجا"، المجلة العربية للعلوم السياسية، العدد 32.
- النوجية الفني للعلوم (2015) انظر موقع وزراة التربية لدولة الكويت www.moe.edu.kw
- جابري، محمد عابد (2010) الهوية العربية أنظر موقع الدكتور محمد عابد الجابري www.aljabiabed.net
- **American Association for the Advancement of Science (AAAS) (1990).**
- ***Science for All Americans*. New York: Oxford University Press.**
- **Chambers, D. W. (1983). Stereotypic images of the scientist: The Draw-**
- **Scientist Test. *Science Education,* 67(2), 255–265.**
- **Milford, T. M., & Tippett, C. D. (2013). Preservice Teachers' Images of**
- **Scientists: Do Prior Science Experiences Make a**
- **Difference?. *Journal of Science Teacher Education*, *24*(4), 745-762.**
- **Narayan, R., Park, S., Peker, D., & Suh, J. (2013). Students' images of**
- **scientists and doing science: An international comparison study. *Eurasia Journal of Mathematics, Science & Technology Education*, *9*(2), 115-129.**

## DEVELOPMENT WORKSHOPS

### Science Literacy: How to Learn-to-Read & Learn-to-Write in Science?

*Suha Hashash, Hariri High School II, Beirut, Lebanon*

"Science Literacy: How to learn-to-read & learn-to-write in science?" allows students to grasp science concepts and comprehend texts by engaging them in authentic inquiry experiences combined with reading, writing, and verbal communication. While many students acquire science content through inquiry and classroom instructions alone, those who read, write and talk about science go beyond what's presented in class. A study by Swan (2003) showed that those students who observed and interacted with scientific phenomenon in combination with access to interesting texts gained greater conceptual knowledge of the science content and experienced greater engagement than those without the literacy connection. In this workshop, participants will get to know the importance of being a science literate. They will also get engaged in a series of hands-on activities that enhance students' reading and writing skills based on reading and writing strategies described during the session. In addition, they will observe elementary students' work in reading and writing in science. Finally, recommendations will be made clear regarding how the school curriculum should be designed in a way to target science literacy and how important it is for teachers to empower themselves with knowledge, hands-on-activities, worksheets and skills that make them go beyond adopting the science books as their only teaching tools only.

In this century, science has a dramatic impact on the quality of personal lives, on the environment, and the world's economy. To prosper in this new century, our students-all of them-must become scientifically literate and embrace the notion of lifelong learning in science.

Science and the communications skills of reading and writing are natural partners for today's elementary classroom. The teaching of science concepts combined with communication skills is an approach whose time has come for two major reasons. First, there is a general recognition of the need to make instruction meaningful and relevant to the real world of students. A second reason for emphasizing communication skills through science instruction is that more and more content is being packed into the school day. This workshop will guide teachers to introduce their students to the world in which they live and to teach reading and writing skills in a meaningful context. This will help students see themselves in what they read—which is very motivating. This meaningfulness and real-world approach enhances students' comprehension of what they read and write.

**Redesigning Chemistry to Improve Students' Thinking**

*Sarwa Al Akkad Hankir, Houssam Eddine Hariri High School - Saida, Lebanon*

It's the 21st century, the era of technology, and most educators have become quite aware of the 21st century skills. They are a set of abilities that students need to develop in order to succeed in this age. When most workers held jobs in industry in the previous century, the key skills were being enlightened about a trade, getting along with others, following directions, working hard, and being professional, honest, and fair. Schools have done an excellent job in teaching these skills and students still need them. However, to hold technology age jobs, students also need to think deeply about issues, solve problems creatively, collaborate and work in teams, communicate clearly, learn ever-changing technologies, and deal critically with a flood of information. The rapid changes in our world oblige students to take the initiative, to lead when necessary, to be flexible, and to produce something new and useful. Technology is by far the most popular topic concerning education in the 21st century, but let us make this point very clear, that technology is not the solution for the 21st century educational problems. It's simply a tool to aid teaching and learning, and it should be incorporated in all classrooms. Therefore, the purpose of this workshop is to share the challenges we face in teaching chemistry for 21st century learners, and how we can "REDESIGN CHEMISTRY" in order to develop the higher order thinking skills of lifelong learners.

We have transferred from the information age to the digital age whereby new skills are needed every day to race the change. Therefore, teaching Chemistry is no longer about delivering the content to students who should learn about whatever information they want with just a click. Students also need to acquire new skills like the critical, analytical and creative thinking skills. Thus, it's highly imperative that we redesign the Chemistry curriculum to meet these standards.

**Strategies:**

This workshop combines inspiring videos, brainstorming techniques, icebreaking activities, collaborative work and reflection activities to serve the same objective.

**Flow of Session:**

1- Start with an icebreaking activity (all about me BAG) that introduces us to each other and put the attendees into the mood. (7 to 10 min depending on the number of attendees).
2- Introduce myself through the same activity and conclude that each one is unique and one size doesn't fit all and link this conclusion to students.
3- Divide the participants into 4 groups and ask them to brainstorm the issues that they're facing with teaching Chemistry to their students and come up with a decision that we should do something to resolve these issues; we should Redesign Chemistry.
4- Introduce the first step which is the curriculum of Chemistry.
5- Five- minute introduction about the different types of the curriculum: written, taught and assessed and the necessity of alignment of these three types.
6- Discuss the main things that should be added to the written curriculum in order to develop the higher order thinking skills of a lifelong learner and focus on the 21st century skills.
7- Ask the attendees to brainstorm what the 21st century skills that we can develop in Chemistry and watch an inspiring video related to that idea.

8- Explore the taught curriculum and ask the attendees to choose a Chemistry topic and to convince us of the best teaching method for this concept; show at the end that one teaching method is not enough and that one concept can be taught using several techniques.
9- The assessed curriculum will be the last on the list, and it will include an introduction of 7 minutes about the authentic assessment and the different types of rubrics through giving each group a rubric and asking them to convert it into another level and discuss the results of the groups.
10- End the session by showing all the attendees that we are doing a great work and make a creative closing activity by asking each one of them to create a definition of himself using the letters of his own name; I will share them mine.
11- All the attendees will be kindly asked to write down a reflection and link this thing to the assessed curriculum part; it's important that we always ask our students to reflect on everything they do in their lives_ not only at school_ because we can learn best from our mistakes.

**Conclusion:**

Chemistry has always been a discipline that's hard to deliver to students, and one of the reasons why, is the curriculum. Focusing on content rather than concepts, working to develop lab skills rather that analysis skills, and diverging the target of the students from succeeding in life to passing the official exams, these reasons ensure that this curriculum needs a redesign. By implementing new teaching and assessment strategies and focusing on concepts we can guarantee that we are developing a lifelong learner who acquires critical, analytical and creative thinking skills that are among the 21st century skills.

**References:**

http://www.p21.org/our-work/p21-framework
http://edglossary.org/21st-century-skills/
https://www.authenticeducation.org/ubd/ubd.lasso
http://edglossary.org/coherent-curriculum/
http://edglossary.org/alignment/
https://www.teachingchannel.org/aligning-curriculum-module-sac
http://www.ascd.org/publications/books/103011/chapters/Using-Standards-to-Integrate-the-Curriculum.aspx
http://www.ucdoer.ie/index.php/Using_Biggs'_Model_of_Constructive_Alignment_in_Curriculum_Design/Introduction
http://allinbrownsville.org/educators/curriculum-alignment/what-is-curriculum-alignment-and-why-does-it-matter/

## Contextual Teaching and Learning; A Successful Process For Engaging Students

*Jinan Karameh Shayya, Lebanese University, Faculty of Pedagogy, Lebanon*

Contextual teaching and learning (CTL) is a system that stimulates the student's brain to weave patterns that express meaning. It is a brain- compatible system of instruction that generates meaning by linking academic content with the context of student's daily life (Johnson, 2002). CTL motivates learners to take charge of their own learning and to make connections between

knowledge and its applications to the various contexts of their lives as family members, as citizens, and as workers (Sears, 2001).

The concept is not new; the application of contextual learning was first proposed (at the turn of the 20th century) by John Dewy who advocated a curriculum and a teaching methodology tied to children's experiences and interests (Pearson, 2001).

As for the definition of "context", it means much more, surely, than events located in place and time. Context also consists of unconscious assumptions absorbed and gained, as if by osmosis, of a world view that unobtrusively shapes our sense of reality. Conclusions, choices, and decisions create our context (Johnson, 2002).

Main Objectives for Contextual Teaching and Learning (University of Southern California, Center of Excellence in Teaching, 2015) are:

- Recognize the need for teaching and learning to occur in a variety of contexts such as home, community, and work sites ( Experiential Learning)
- Anchor teaching in students' diverse life-contexts
- Emphasize problem -oriented project based learning
- Encourage students to learn from each other and together (Peer Learning, Collaborative Learning, Cooperative Learning)
- Teach students to monitor and direct their own learning so they become self-regulated learners ( Integrative Learning, Intentional Learning).

These objectives are assessed using problem- oriented performance tasks that are either designed by teacher in lower grades or by students in higher grades using G.R.A.S.P. steps (Goal, Role, Audience, Situation, and Product). This model is inspired from Understanding By Design or UbD, which is a tool utilized for educational planning focused on "teaching for understanding" advocated by Jay McTighe and Grant Wiggins in their Understanding by Design (1998), published by the Association for Supervision and Curriculum Development.

1. Goal - The Goal provides the student with the outcome of the learning experience and the contextual purpose of the experience and product creation.
2. Role - The Role is meant to provide the student with the position or individual persona that they will become to accomplish the goal of the performance task. The majority of roles found within the tasks provide opportunities for students to complete real-world applications of standards-based content.
3. Audience - The Audience is the individual(s) who are interested in the findings and products that have been created. These people will make a decision based upon the products and presentations created by the individual(s) assuming the role within the performance task.
4. Situation - The Situation provides the participants with a contextual background for the task. Students will learn about the real-world application for the performance task
5. Product - The Products within each task are designed using the multiple intelligences. The products provide various opportunities for students to demonstrate

understanding. Based upon each individual learner and/or individual class, the educator can make appropriate instructional decisions for product development.
The objectives of this session are (1) introducing the term CTL, (2) Investigating the importance of CTL in science education, (3) Identifying strategies to implement CTL in science classroom, (4) Unit and Lesson planning to implement CTL in science classes, and (5) Evaluating students' achievements.

This session is targeting science teachers and coordinators for all levels. Participants will have the chance to share their experiences in this issue and reflect on their own practices and challenges that they usually face when implementing CTL.

The session will start with an icebreaker activity (5min), the presenter will introduce the term CTL and its importance in science teaching (10 min), and then the participants will watch a short video shedding light on CTL strategies in the classroom (10 min). The presenter will suggest a planning strategy involving performance tasks and project based learning that will facilitate implementation of CTL (10 min). The participants will be given the chance to interact in groups to apply the planning strategy discussed by suggesting a plan for different science topics for different levels (assigned by the presenter), each group will present the suggested plan to be discussed by others (35 min). The presenter will propose model plans for the assigned topics (10 min). Assessment criteria for students' achievements will be discussed by the presenter who will provide effective rubrics for evaluation (10 min). The participants in groups will use these rubrics to evaluate presented students' projects and tasks (10 min).

CTL practices ensure meaningful science learning leading students to become good and effective citizens through training them to solve contextual national problems and providing them with effective leadership skills to rise up with our country.

**References:**


- Pearson, Sarah S. (1999). Contextually Based Learning: Fad or Proven Practice, forum brief, July 9, 1999. [American Youth Policy Forum held on June 9, 1999, on Capitol Hill].

- Advanced Technology Environmental Education Center (2001). Teaching for Contextual Learning: Background on Contextual Teaching and Learning (CTL).
- Sears, Suzan J. (2002). Contexual Teaching and Learning; A primer for Effective Instruction. Phi Delta Kappa Education Foundation, USA, 2002.

- Johnson, Elain B. (2002). Contexual Teaching and Learning: What it is and why it's here to stay. Crown Press, USA, 2002.

- http://jaymctighe.com/wordpress/wp-content/uploads/2011/04/UbD-in-a-Nutshell.pdf

**Thinking Science Labs**

*Nibal Hamdan Barq, Greenfield College, Beirut, Lebanon*

The main purpose of laboratory activities is helping students better understand the natural world rather than illustrating lecture courses. Many lab activities have turned into rote exercises in which students merely follow given instructions. This workshop presents, through hands-on activities and audiovisual demonstrations, the strategies that can be followed to design inquiry-based practical investigations that can develop learning skills. These strategies shall enable students to search for and use evidence to explain natural phenomena and abstract ideas that relate to everyday life. Inquiry-based practical investigations teach how to gain knowledge by looking at reality not to make reality conform to scientific preconceptions. Participants will design and do a practical investigation and will then be asked to write a report to communicate and critique their findings. The organizational structure of a science report: cover page, abstract, introduction, design (variables, materials and procedure), results (data collection and processing), discussion (conclusion and evaluation), and referencing will then be briefly explained, along with examples of students' reports. A proposed list of investigations designed for different levels will also be shared with the participants in this session.

The session shall proceed as follows: (1) Participants will first be divided into groups according to the class level they teach. (2) An icebreaker that introduces the purpose of this workshop shall follow. (3) Practical investigations will then be defined and classified through an activity. (4) Examples of labs suggested in some science books are given and their drawbacks are highlighted. (5) The general guidelines that can be followed to design a practical investigation shall follow. (6) Participants will then be asked to explain the science concepts behind very simple observations from everyday life (such as using a straw to drink juice, cleaning a spot of oil, lighting a candle, clotting of an injured cut, pickling cucumbers and many others). They will then realize that these simple observations can lead to complex practical investigations. (7) Using a set of materials, participants will then be asked to design and do an investigation that relates to a science topic that they will randomly choose from a set of cards. (8) Participants will then be asked to write a science report to describe and critique their findings. All will share their reports and discussions of the organizational structure of a science report shall follow.(9) A suggested template of a science report that includes a cover page, an abstract, an introduction, a design (variables, materials and procedure), results ( data collection and processing), discussion (conclusion and evaluation), and referencing will then be briefly explained, along with examples of students' reports. (10) At the end, a suggested list of possible practical investigations will be shared with the participants in this session.

**How to Make Science Accessible to English Learners?**

*Rana El-Iskandarani & Amina Harbali, Hariri High School II, Beirut, Lebanon*

In order for students to develop scientific literacy, they need to gain knowledge of science content and practice scientific habits of mind. However, students studying science using English as a second language face the most obvious challenge in learning science since they have to learn a new language, and, at the same time, they are required to acquire new scientific concepts. To ensure that these students have every opportunity to learn and succeed in science, high quality science instruction should meet their learning needs and understanding of science. Teachers ought to play a role in minimizing the language barrier in science learning by being the language and content mediators in the science classroom. As a result, teachers will optimize their students' potential in learning science. In this workshop, participants will be involved in using authentic materials, hands on approaches and visual representations and similar strategies to help meet the needs of students learning science using English as a second language to acquire a better understanding of science.

The primary purpose of this session is to increase participants' understanding of how to use different strategies to develop students' understanding of science. During the session, participants will take on the role of the learner by actually using a variety of strategies in order to increase their development of listening, speaking, reading and writing skills in science by keeping them involved and engaged in many activities.
During the session, participants will be asked to move around and work in groups to discover new information. At the end, they will acquire the appropriate skills that entitle them to learn and understand science, using the English language.

The session is planned as follows:

1. Brain teasers as ice breakers **(5 minutes)**.
2. Brief introduction about the chosen title and pace of the workshop **(5 minutes).**
3. Participants will have the chance to get involved in different activities each of which follows a different strategy .These activities are related to one topic for the middle and secondary levels. Participants will work in different learning centers, one center at a time, to explore each strategy. **(70 minutes)**
4. These activities will be followed by a brief discussion about each strategy. **(25 minutes).**
5. Break. **(5 minutes).**
6. Participants will summarize the main issues that were discussed during the session, discussing the limitations and feasibility of applying and implementing these strategies across different disciplines. **(10 minutes)**

## Using Students' Written Artifacts and Teacher-Student Conversations to Develop Teachers' Noticing of Students' Mathematical Reasoning

*Rabih El Mouhayar, American University of Beirut, Beirut, Lebanon*

The purpose of this workshop is to involve mathematics teachers in activities that may help them develop their professional noticing skills of students' mathematical reasoning. During this workshop, the participants will work on two main activities. During the first activity, participants will analyze students' written artifacts in order to unpack students' thinking in pattern generalization tasks. During the second activity, participants will analyze vignettes about teacher-student conversations in two instructional settings. Analyzing the vignettes will help participants to list and identify techniques that teachers may use to strengthen students' mathematical thinking and understanding.

In mathematics classes teachers are expected to notice their students' thinking and to adapt their instruction accordingly (van Es & Sherin, 2002). However, teachers are not able to respond to their students thinking without a determined intention to do so, and this intention reflects their ability to attend to their students' thinking, interpret their students' understanding and decide how to respond (Jacobs, Lamb, & Philipp, 2010). Using these three skills in an integrated manner is what allows teachers to effectively notice students' thinking and thus may allow them to successfully execute instructional events (Jacobs, Lamb, & Philipp, 2010). One of the major goals of this workshop is to develop teachers' dispositions to value teacher professional noticing and inquire into students' mathematical thinking as a regular part of teachers' classroom practices. Another goal is to unpack students' mathematical thinking in rich mathematical tasks.

The goals of the workshop is to : (1) work on students' written artifacts in order to unpack students' thinking in pattern generalization tasks; and (2) list and identify techniques that teachers may use to strengthen student's mathematical understanding.

The workshop is divided into two main activities. During the first activity (**60 minutes**), the facilitator will involve the participants in solving pattern generalization tasks and then in discussing the different strategies adopted to solve the tasks. Then, the facilitator will distribute handouts containing students' solution concerning those tasks and will ask the participants to analyze students' thinking in each pattern generalization task. In particular, the facilitator will ask the following questions: (1) What has the student done in response to the task? (2) How might we interpret the student's work in the context of pattern generalization and algebraic reasoning and how would we describe what the student understands about pattern generalization and algebraic reasoning? (3) How might one decide on an appropriate next instructional step in the context of pattern generalization and algebraic development? What sorts of teaching moves might be most effective to develop student understanding? During the first part of the activity (generalizing patterns), the participants will work in an individual manner to generalize the patterns. However, during the second part of the activity that addresses the analysis of students' work, the participants will sit in groups of four and they will create joint understanding and interpretation of students' algebraic thinking in pattern generalization tasks. At the end of this

activity, participants will discuss the meaning of teacher noticing and what skills it involves. Participants will also discuss the value of developing those skills in mathematics teaching.

During the second activity (**60 minutes**), the facilitator will involve the participants in: (1) solving two mathematical tasks (one that addresses the concept of equivalent fractions for common percent and the other addresses the knowledge of circle concepts – radius, diameter and circumference); (2) anticipating students' thinking in each task; (3) analyzing teacher-student(s) conversation for each of the two mathematical tasks to come up with a list of techniques that teachers have used to strengthen students' understanding. At the end of this activity the participants will brainstorm different strategies that the teachers may use to strengthen students' reasoning and mathematical understanding.

At the end of the workshop the facilitator will involve the participants in a discussion about the importance of developing teachers' professional noticing of students' reasoning and its impact on teaching.

**References**

Jacobs, V., Lamb, L., & Philipp, R. (2010). Professional noticing of children's mathematical thinking. J*ournal for Research in Mathematics Education*, 41(2), 169-202.

van Es, E.A., & Sherin, M.G. (2002). Learning to notice: Scaffolding new teachers' interpretations of classroom interactions. Journal of Technology and Teacher Education, 10(4), 571-596.

## Using Communication Skills in Mathematics

*Dounia Sawan, Makassed-Houssam Eddine Hariri High School, Saida, Lebanon*

Learning mathematics involves learning how to read, write, listen and discuss mathematical concepts and theories. Language skills of reading, writing, speaking and listening are at the heart of mathematical communication. This, in turn, helps students understand mathematics and employ it in real life situations. By the end of this workshop, participants will be able to guide their learners to express their mathematical understanding and write reflectively about mathematics.

Mathematical communication means meditation and thinking in cognitive processes and mathematical ideas, describing the procedures and conclusions for solving math problems, and finding explanations and justifications for Math solutions. The purpose of the workshop is to introduce teachers to learning activities that enhance their students' mathematical thinking and writing skills. Throughout the workshop, the participants will be playing the role of the students as they engage in different activities that require the use of mathematical communication skills.

The session is planned as follows:

(a) **Introductory Question**: What is Mathematical Communication? Record participants' answers on a flip chart and discuss the answers**.** Participants will be given the technical definition upon which the proceedings of the workshop will be based. **(15 min)**

(b) **Description of the session:** the session will be divided into three parts separated by two breaks. It is planned as follow:

(i) **Activity 1: Forms of Mathematical communication**

Participants are given a problem and they will work in groups of three. A group will be asked to present their solutions and what kind of mathematical communication they used to arrive at the solution. Participants will be asked if there are other ways to solve the problem and another group will be asked to present the way they thought of the solution. Samples of how students might think about these problems will also be presented and discussed. This will allow participants to deduce the importance of discussion and the use of mathematical language for students in developing their critical thinking, their mathematical ideas and strategies, precisely and coherently, to themselves and to others. Following the analysis and discussion of the solutions, we will focus on how different forms of writing can help students reflect on their learning, organize ideas, improves comprehension, and memory. **(35 min)**

(ii)**Break 1: Brain Teasers**

To motivate participants and help them to implement the same activity in their classes to make the session more fun. **(15 min)**

(iii)**Activity 2: Teacher's role**

Participants are invited to work in pairs and discuss the teacher's role in mathematical communication process. This activity will be followed by a brief presentation from each group .There will also be a representation regarding the teacher's roles and duties. **(20 min)**

(iv)**Break 2: Trick questions**

Participants will try to answer trick questions, and then connect them to Math concepts. This activity can also be used in the classroom to release the state of boredom during two consecutive sessions. **(10 min)**

(v) **End of the session**:

Participants will take a look at some samples of students work from my school. These samples represent different types of mathematical writing and how it was assessed.

At the end of the session, participants are invited to write a reflection .In groups, they will reflect on :"How can I benefit from this session to motivate my students and solve their problems in Mathematics?"

The ideas will be posted on the wall for discussion. Groups will read them rapidly then select the most suitable reflection and decide how to use it as an Action Plan in the Math class. **(20 min)**

**Math In Singapore**

*Hasan Dinnawi, Wellspring Learning Community, Lebanon* **&** *Amin Dinnawi, Thamer School, Saudi Arabia*

In this workshop, we will be sharing some of the benefits of Singapore math. It is a visual approach that helps students focus on real life word problems, provides strategies for struggling learners and is considered an extension that can challenge gifted and talented students. It enhances students' critical thinking, teaching them "how to think" not "what to think".

It is such a pleasure to share what we have learned from Singapore math. The main question becomes why the interest in Singapore math?
This small country went from below performing in mathematics globally in the 80's to a very high performing nation in the 90's and of course today. So in this workshop we will be sharing some of the benefits of Singapore math and more importantly some of the strategies. We are going to see some modellings, it is a visual approach and helps students focus on word problems and helps students focus on word problems. It helps all students especially those struggling learners and it also serves as an extension strategies to challenge gifted and talented students.
Strategy:

- Number bonds (Fact Family) ex: " 7" is 6+1 , 5+2 , 3+4
  Thus 98 + 7 = 98 + 2 + 5 = 100 + 5 = 115
  Mastering the number bonds in order to make groups of 10.

- Changing the typical procedure.

  Ex: $\frac{5}{7}+\frac{4}{7}=\frac{5}{7}+\frac{2}{7}+\frac{2}{7}=1\frac{2}{7}$

- Developing the traditional ways

Ex: $\begin{array}{r} 6 \rightarrow +3 \\ \underline{-4 \rightarrow +3} \\ 2 \end{array}$ *will give the same value as* $\begin{array}{r} 9 \\ \underline{-7} \\ 2 \end{array}$

*Thus* $\begin{array}{r} 5000 \rightarrow -1 \\ \underline{-3267 \rightarrow -1} \end{array}$ Gives $\begin{array}{r} 4999 \\ \underline{-3266} \\ 1733 \end{array}$

Description of session:
The participants will be sitting in groups of fours or fives.

- The workshop will start with an introduction for 10 min.
- The workshop will start with a problem solving, the participants will take 3 min. to write down the system.
- Explaining the tiles and modellings within (5 min.)
- Start activity 1 then sharing it together. (10 min.)

- Furthering with the methodology structure. (10 min.)
- Start activity 2 then sharing it together. (15 min.)
- Continue with the multiplication and division. (7 min.)
- Start activity 3 then sharing it together. (15min. to 20min.)
- Finishing with the third category: Before and after strategy. (10 min)
- Start activity 4 then sharing it together. (15 min.)
- Going back to the starting problem solving and solve it using the new methodology. (5 min.)
- Closing. (5 min.)
- Opening the door to questions. (5 min.)
- Complete the evaluation sheet. (5 min.)

This workshop can be sent via email for the participants in case they are interested in. A plan of action can be discussed and agreed on to come in handy.

**Flipped Learning: Reaching Every Student**

*Salam Khalil, Al Ahliah School, Beirut, Lebanon*

Flipped learning is a pedagogical approach, created by Jonathan Bergmann and Aaron Sams, in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creativity in the subject matter. The presenter applied this technique in her Grade 10 Math classroom and would like to share the experience with the participants. The objective of this workshop is to present the idea of Flipped Classroom and the means to apply it in Middle and Upper School Classes, in relation to the objectives and goals of the "Flipped Learning Network".

The goals of this development workshop are to introduce the concept of flipped learning; familiarize the participants with approach of flipping classrooms; to experience a hands-on activity in which attendees will practice applying flipped learning on a basic level in their classrooms.

The goals, objectives, methods and tools of flipped learning are presented through a PowerPoint presentation (20 minutes); a sample of an implemented lesson using this approach will be presented to participants; followed by sharing students' opinion and feedback of the approach that was gathered by the presenter through surveys and discussions after the implementation of the approach (20 minutes). The presenter will share the experience of using flipped learning using the model lesson and sharing the results of the survey.

How to transform a regular classroom into a flipped classroom is the main goal for the participants by the end of the session. The presenter will introduce Office Mix, Screencast-O-Matic and recording videos which are methods and tools used to create a flipped classroom. Participants will be introduced to different tools (15 minutes) with a brief explanation on how to use each one in order to create a lesson. Screencast-O-Matic is an online video recording which

can be used to create/record videos to be used in preparing a flipped classroom. Attendees will be able to apply it, guided by the presenter, by working in groups of two or maximum three and then present their work to all participants (30 minutes). Participants divided in groups will get the chance to choose, prepare and present the lesson/project.

A reflection and a discussion (15-20 minutes) will take place after presenting the prepared lessons by the participants on how to make their classroom more interactive by using flipped learning and sharing advice and comments among other participants.

By the end of the session, the presenter will distribute handouts and share important and useful resources and links to help participants in applying and using this approach easily.

Material used: over head projector or a smart board, computers with direct access to the internet, microphone/headphones, handouts describing the plan of the activity in details and handouts includes tips on how to apply flipped classroom.

The following resources can be used for further reading and applying flipped learning:
www.flippedlearning.org
http://www.edutopia.org/blogs/tag/flipped-classroom
http://www.edutopia.org/video/flipped-learning-toolkit
Flip your classroom: Reach every student in every class every day by Jonathan Bergmann and Aaron Sams
Flipped Learning: Gateway to Student Engagement by Jonathan Bergmann and Aaron Sams

**School Science and Mathematics for Preparing Responsible Citizens**

*Hagop A. Yacoubian, Haigazian University, Lebanon*

Even though the vision and mission statements of many schools may target the preparation of responsible citizens, it is sometimes assumed that citizenship education is beyond the scope of school science and mathematics and that it mainly falls within the boundaries of the civics class. School science and mathematics have integral role in the development of future citizens who can be responsible for understanding as well as shaping the societies in which they live, participate and function (Bencze, 2010; Hodson, 2003; Frankenstein, 2009; Simmt, 2014). Future citizens need to learn to examine social issues and make well-informed decisions on them. A number of those social issues have components of science and mathematics in their background context. In Lebanon, the current garbage crisis and unemployment, for instance, might constitute examples of such social issues. It is indispensable that future citizens develop a critical mindset so that to examine those social issues (Author, 2015). Such a vision for school science and mathematics is significant from a democratic standpoint. Many of these issues prevalent today are intricately linked to broader political, social, and economic systems and can be situated within the broader neoliberal and neoconservative ideologies (Apple 2006, Bencze 2010). It is imperative that future citizens are guided to practice exploring critically those social issues as well as their

intricate connections with the broader political, social, and economic systems in which they often get shaped.

**Strategy**

In this workshop a teaching strategy derived from the work of a number of scholars in science and mathematics education (e.g., Bencze, 2010; Hodson, 2003; Frankenstein, 2009; Simmt, 2014) will be used as a basis for creating learning experiences for the participants. The teaching strategy involves engaging learners in critical exploration of the causes and implications of social issues at the explicit level followed by critical exploration of the issues in question within the broader social, political and economic system.

Description of the Session

The workshop coordinator will utilize a learning cycle consisting of exploration, invention and application phases in order to introduce the teaching strategy discussed above.

After an introduction (15 minutes), the participants will play the role of secondary students and engage in exploration of a social issue in small groups, using the strategy discussed in the previous section, guided by the workshop coordinator (30 minutes). The science teachers will engage in exploring the issue of garbage crisis in Lebanon while the math teachers will engage in exploring the unemployment rate in Lebanon. The purpose of engaging in these activities are (1) to gain some hands-on experience in exploring a social issue that has a science/ mathematics component in its background context, (2) to explore how the two issues in question are intricately linked to broader political, social, and economic systems, (3) to use the activities as a basis to reflect upon the teaching strategy in question.

Next, a group discussion will take place where the participants will put back their teacher's hat and based on their experience of engaging in the activities they will be guided to reflect on how to guide future citizens to practice exploring social issues and how to empower them to engage in critical deliberation on these issues without taking the underlying status quo for granted (30 minutes). The purpose of this phase is for the participants to identify the characteristics of the teaching strategy.

Finally, the participants will apply the teaching strategy in order to develop similar activities while working in small groups. The workshop coordinator will move around and provide feedback. A whole-group discussion will follow. The purpose of this phase is to apply some of the skills learned for crafting science and mathematics learning experiences for future citizens to engage in critical exploration of both the social issues and the broader political, social and economic systems in which particular issues get shaped (30 minutes).

The last 15 minutes of the session will be devoted for wrapping up the sessions, comments, suggestions, questions and session evaluation.

**Conclusion**

It is important to note that some participants would need to reimagine their role as science and mathematics teachers considering that a number of ideas raised in the workshop assume the teachers to get out of their comfort zone and (re)question taken-for-granted goals of science and mathematics learning. Consequently, the development of a proper (critical) mindset is important where internalizing certain attitudes might be more crucial than the skills that the participants would develop throughout the workshop. Considering that it is never possible to internalize

attitudes within the 2-hour-timeframe, the workshop coordinator will share with the participants a list of resources that can be helpful in their self-reflective journey.

**References**

Author (2015)
Apple, M. W. (2006) *Educating the "Right" way: Markets, Standards, God, and Inequality* (2nd edition). New York: Routledge.
Bencze, J. L. (2010) Exposing and deposing hyper-economized school science. *Cultural Studies of Science Education,* 5 (2), 293--303.
Hodson, D. (2003) Time for action: Science education for an alternative future. *International Journal of Science Education,* 25 (6), 645--670.
Frankenstein, M. (2009). Using real real-life problems in teaching critical mathematical literacy. In L. Verschaffel, B. Greer, W. Van Dooren, & S. Mukhopadhyay (Eds.), *Words and worlds: Modelling verbal descriptions of situations* (p. 87-98). Rotterdam: Sense Publications.
Simmt, E. (2014). Educating for citizenship in school mathematics. In L. Gearon (Ed.), *Learning to teach citizenship in the secondary school* (pp. 266-278). Oxon: Routledge.

## RADAR: A Framework for Assessing Your Assessment

*Enja Osman, American University of Beirut, Lebanon*

**Introduction:**

Have you ever thought of assessing the assessment policy or system used at your school, department, or class? Have you ever figured out how your assessment might shape your instruction and impact student learning? The RADAR model (Resources for Assessment Design, Alignment and Review) guides you to do so! RADAR is a thinking tool designed to help principals, heads of schools, coordinators, and even teachers reflect on whether the school assessment policies and systems are aligned with good practices drawn from research findings on feedback and assessment. RADAR also provides concrete ideas to improve assessment and feedback practices.

**Strategy:**

One key aspect of the strategy to be discussed is that the constituent tools of the RADAR model are flexible and can be molded to fit the user's scope. For instance, colleagues can opt to apply a single or multiple tools to assess and assess the assessment of individual units, entire programs, or even subsets of modules.

In this workshop, participants will work in groups to learn about the 9 RADAR dimensions of good assessment and feedback practices to analyze their current assessment system. Then, all

participants will be engaged in a hands-on activity to discuss how changes in their assessments might create movement along the different dimensions and design practices to do exactly so.

**Description of session:**

The workshop begins by welcoming participants, breaking the ice, and introducing the purpose of the workshop **(10 minutes).** This is followed by a brainstorming session to explore how participants develop and assess the assessment tools they currently use at their schools **(10 minutes).** The facilitator displays the RADAR model and its 9 dimensions **(10 minutes).** Then, participants are split into groups, assigned different dimensions, and requested to provide examples of evidences or practices pertaining to their assigned dimension **(20 minutes).** Next, the facilitator distributes support cards which include practical ideas that address each dimension and guide participants to identify their locations along these dimensions **(20 minutes).** At this stage, participants draw the first layout of their RADAR model **(5 minutes).** Afterwards, each group reflects on their current practices and suggests modifications to move forward within their dimension **(20 minutes).** Finally, participants are asked to draw the refined layout of their RADAR model and discuss implications for practice **(15 minutes).** Lastly, the facilitator wraps up the session by highlighting major features of the RADAR model and its significant value in improving assessment practices **(10 minutes).**

**Materials Needed:**

- Computer
- LCD Projector
- Flipchart stand/papers
- Handout: RADAR Model ( 25 copy)

**Conclusion:**

The RADAR toolkit provides academic staff with a solid ground to analyze how and to what extent existing assessments are aligned with the good practices identified in educational research. In addition, comparing and reflecting on analysis and design phases, this model is unique in that it provides its users with concrete ideas as to how assessment and feedback arrangements might be improved and the specific areas it can be improved in. It's about time that our educational organizations tune in the frequency of the RADAR-model if we want to see systematic and truly authentic assessment.

**References:** Education Quality & Enhancement, University of Exeter. *Based on work by the Viewpoints project at Ulster University (Funded by Jisc)*

The Radar ToolKit:

https://as.exeter.ac.uk/support/staffdevelopment/aspectsofacademicpractice/assessmentandfeedback/radartoolkitresourcesforassessmentdesignalignmentandreview/

**Learning Math and Science Through Bugs!**
***(Only abstract included for the following session)***

*Lama Marji, Grey Matters Education, Lebanon, & Samah Abou Ghazal, Wellspring Learning Community, Lebanon*

Children are innately curious about the natural world and the living things that inhabit it. Given the opportunity some develop a real interest in small creatures, as they are accessible, varied, and catchable. Through an authentic learning experience the participants will explore various mathematical and scientific concepts that emerge from a bug inquiry. We will consider scientific observation and the role of counting in its many forms to help us see; bilateral symmetry in the design of creatures; nonstandard measurement, magnification, sorting, and organizing. We will also consider the role of drawing and redrawing in scientific observation.

## INNOVATIVE IDEA SESSIONS

**The Science Writing Heuristic**

*Mazen Kotob, Rafic Hariri High School, Saida, Lebanon*

The science writing heuristic (SWH) is a novel design that students employ for their laboratory reports and a teaching method used by the teacher to help arrange the flow of activities associated with an experiment. Instead of completing the five conventional sections in a lab report - purpose, methods, observations, results and conclusions - students are expected to respond to prompts eliciting questioning, knowledge claims, evidence, description of data and observations, methods, and to reflect on modifications to their own thinking. Teachers take an active role in pre-designing activities and teaching students. In the SWH approach, interactive guided-inquiry lab activities are accompanied with student-centered classroom pedagogy including intra-and inter-group discussions and students' nontraditional writings. The learners discuss meaning from experimental data and things they observe. Students structure concepts and the ideas by claiming and supplementing findings from their empirical work.

Most chemistry instructors suppose that if students do a chemistry laboratory activity they will learn something. In the last thirty years, science education researchers have explored what students acquire from science laboratory experiences. One consistent finding is that if traditional laboratory experiments are used with the traditional laboratory notebook format, students may learn some laboratory techniques, but they learn little else. Also, under these conditions, students develop a poor attitude toward science and consider the laboratory activity as a huge waste of their time. Students often view the data collected during a laboratory experiment as artificial. Using a traditional laboratory experiment, students will blindly follow the directions. Then, when the answer generated from data they collect has a large percent error, they blame poor laboratory equipment, human error, or chance. When students are asked to solve problems on lecture examinations or laboratory practical tasks that match what has been presented in

lecture and in the laboratory, average student performance is poor. Incorporating guided-inquiry, Learning cycles, group work, and the science writing heuristic as the basis for each laboratory experiment is the key to helping students increase their conceptual understanding of chemistry and to improve their attitude toward chemistry.

In addition, according to constructivist theories, one reason of writing laboratory reports is to bridge prior knowledge with new learning. But in a standard laboratory report, the students are requested to complete the sections, such as title, purpose, procedure, data, calculations, results and discussion, and are asked to verify science concepts which had already been explained to them. This situation seems resemble the general characteristics of science education that is memorizing the facts and procedures. One way that the students can learn required science concepts from laboratory activities is to let them determine the result of on investigation activity while presenting their laboratory reports by using a more flexible format.

The science writing heuristic (SWH) can be understood as an alternative format students use for their laboratory reports, and a teaching technique used by the instructor to help format the flow of activities associated with the experiment. Instead of responding to the five traditional sections, purpose, methods, observations, results and conclusions, students are expected to respond to prompts eliciting questioning, knowledge claims, evidence, description of data and observations, methods, and to reflect on changes to their own thinking. Instead of taking a passive role, instructors take an active role in pre-designing activities and teaching students. The SWH student laboratory report template prompts students to generate questions, claims and evidences for their claims. This template also asks students to compare their findings with others, including text books, other students, internet and different sources. The following table provides an overview of the student template and the teacher template for the SWH. (Akkus, Gunel, & Hand, 2007)

**Strategy**

| The Science Writing Heuristic, Part I<br><br>A template for teacher-designed activities to promote laboratory understanding. | The Science Writing Heuristic, Part II<br>A template for student. |
|---|---|
| 1. Exploration of pre-instruction understanding through individual or group concept mapping or working through a computer simulation.<br>2. Pre-laboratory activities, including informal writing, making observations, brainstorming, and posing questions.<br>3. Participation in laboratory activity.<br><br>4. Negotiation phase I - writing personal meanings for laboratory activity. (For example, writing journals.)<br>5. Negotiation phase II - sharing and comparing data interpretations in small groups. (For example, making a graph based on data contributed by all students in the class.)<br>6. Negotiation phase III - comparing science ideas to textbooks for other printed resources. (For example, writing | 1. Beginning ideas - What are my questions?<br><br>2. Tests - What did I do?<br><br>3. Observations - What did I see?<br>4. Claims - What can I claim?<br><br>5. Evidence - How do I know? Why am I making these claims?<br><br>6. Reading - How do my ideas compare with other ideas? |

| | |
|---|---|
| group notes in response to focus questions.)<br>7. Negotiation phase IV - individual reflection and writing. (For example, creating a presentation such as a poster or report for a larger audience.)<br>8. Exploration of post-instruction understanding through concept mapping, group discussion, or writing a clear explanation. | <br>7. Reflection - How have my ideas changed?<br><br>8. Writing ≠ What is the best explanation that explains what I have learned? |

## Description of session

| | Activity | Description | Time min. | Nature of involvement |
|---|---|---|---|---|
| 1 | Introduction | Explain the SWH strategy | 10 | Discussion, power point |
| | Comparison | Compare it to traditional work | 10 | Discussion |
| 2 | Activity | Model the work of teacher and students by performing actual experiment | 20 | Group work |
| 3 | Other examples | Show the audience the application of the SWH on a variety of experiments in chemistry | 10 | Power point presentation |
| 4 | Show samples | Share Sample report of work done by students | 10 | Group Discussion |
| 5 | Assessment | Discuss rubric to evaluate students' work in the SWH | 10 | Group work |
| 6 | Conclusion | Advantages and Disadvantages | 5 | Group discussion |

## Conclusion

In the SWH approach, interactive guided-inquiry lab activities are accompanied with student-centered classroom pedagogy including intra-and inter-group discussions and students' nontraditional writings. The learners discuss meaning from experimental data and things they observe. Students organize concepts and the ideas by claiming and supplementing results from their empirical work. Several empirical studies pointed out that students show deeper understanding of science and positive attitude toward science when the teacher effectively implemented the SWH within mainly chemistry (Akkus, Gunel, & Hand, 2007).

## Reference

Akkus, R., Gunel, M., & Hand, B. (2007). Comparing an inquiry-based approach known as the science writing heuristic to traditional science teaching practices: Are there differences? International Journal of Science Education, 1, 1-21.

**Differentiating Instruction**

**(Only abstract included for the following session)**

*Mohammed Salim Estaiteyeh, German International School, Beirut*

Differentiated instruction is a constructivist-based teaching approach that aims to achieve learning for all students of diverse socio-cultural backgrounds, abilities and interests. Studies have revealed that when teaching methods are not aligned with students' learning styles, this negatively influences their academic performance and commitment to attending classes. Hence, effective instruction requires considering students' individual differences. Differentiating instruction entails modifying one or more of the following: content, process or product. This workshop will provide science teachers across all levels with the knowledge and skills needed to differentiate their instruction using Tomlinson's theoretical framework. The examples will be based on the Genetics unit addressing the following concepts: Chromosomes, Karyotyping, DNA Structure, DNA Replication, DNA Transcription, Translation, Mutations, Genetic Engineering, Dihybrid Crossing, and Pedigree Analysis. Teachers will be able to prepare differentiated lessons for all other sciences. Supplementary resources will be provided for participants to integrate differentiation in their future planning.

**Math In Action**

*Israa Fawaz & Abed Al Wahab Kassir, Makassed-Houssam Eddine Hariri High School, Saida,Lebanon.*

Do you think you can get rid of chalks and boards? Did you ever imagine revising your math lesson through games? Do you think you can integrate education with fun? It's time to put Math in Action!! This workshop tackles the topic of how schools are shifting toward project-based learning, inquiry-based learning, cooperative learning and many other learning strategies as a way of increasing engagement and creativity in the classroom. It's not a matter of simply marking the end of a lesson or unit by making a book or a diorama; instead, new learning strategies engage students in deep-level meaningful, long-term projects that are themselves the learning experience. This workshop is going to show how students and teachers play an equal role in the learning process through various learning strategies that develop students' deep understanding and analysis skills with the integration of theatrical performances and innovative and creative activities.

This workshop aims at providing teachers and educators with innovative and creative ideas that can be applied to wrap up different mathematical lessons through theatrical performances. In this session, participants will encounter a variety of activities aimed at enriching their understanding and implementation of new learning strategies. Mathematics makes a lot more sense when it is applied to real (or authentic) situations .From the beginning till the end of the session, participants will be actively involved in interesting hands-on activities that enrich their understanding of creative thinking to develop the conceptual knowledge of integers, bar graphs, geometric representations, and other math concepts.
<u>The session is planned as follows</u>:
a) Inspirational video that highlights on creative thinking. (5 minutes)
b) "Ice breaking" activity to get acquainted and introduced to each other. (5 minutes)

c) Identifying the objectives of the workshop through an interactive math activity. (5 minutes)
d) Brief introduction on educational trends- like learner orientation- that are leaving growing impact upon education. (10 minutes)
e) Participating in theatrical activities that encourage creative thinking for problems that are related to integers, bar graphs, and geometric representations. (15 minutes).
f) Participants will experience various mental math strategies, math teasers, and kangaroo patterns. (15 minutes)
g) Presenting a video prepared by students of HHHS showing the implementation of creative thinking throughout theatrical performances at school and dealing with the concept of congruent triangles. (10 minutes)
h) Engaging attendees Gallery walk and reflections on workshop ideas and topics presented. (5 minutes)
i) At last, participants will reflect on the journal how what learnt could be used in a certain Math concept. (5 minutes)

**Alternative Methods for Factoring Polynomials**

*Mariana Fakelova-Abou Habib & Hiba Othman, American University of Science and Technology, Lebanon*

Factoring ISN'T important to most people in everyday life. In shopping and cleaning and cooking and going to the movies. But many occupations use different kinds of mathematics, ranging from accountants to carpenters to scientists and engineers to people who work to protect the environment. Many of them will sometimes need to use factoring, but factoring isn't a goal in itself. Factoring is used to solve different kinds of problems. I think many people might want to know why we should learn factoring if we aren't ever going to use it "in real life."
Most of us don't know what we will be doing in real life until it happens to us. Sometimes we plan for it and sometimes it takes us by surprise. But it is a good idea to be prepared. If you don't know ANY mathematics then there are hundreds, maybe thousands of jobs that you won't be able to do. For most of these jobs mathematics isn't the main point of the job, it is just one of the many tools that are used. So if you don't know mathematics you may be losing the opportunity to do something that you would find exciting and worthwhile.
So why factoring quadratics is so important?
One is to make complicated things look simpler. Like reducing complex algebraic fractions.
A second important use of factoring is in solving equations. You don't need to factor to solve $2x+3 = 5$ ... linear equations use a different method. And you don't need to factor second degree equations because you can use the Quadratic Formula (although factoring is often MUCH easier!). But if you need to solve equations where the degree of the highest term is more than 2 then you really have no choice at all because you don't have formulas for most of them.
Polynomial factoring is pretty useful:

- Our system is a trajectory, the “desired state” is the target. What trajectory hits the target?
- Our system is our widget sales, the “desired state” is our revenue target. What amount of earnings hits the goal?
- Our system is the probability of our game winning, the “desired state” is a 50-50 (fair) outcome. What settings make it a fair game?

None of the answers so far justify making grade 9 or 10 students pointlessly factor polynomials. And for most students, it is indeed a waste of time. Unfortunately, if it were removed from the high school math curriculum, it would be impossible to go on. Sometimes in life you have to solve a quadratic equation. Not just in school, but in life. It is the basic equation that comes into play when competing factors have to be optimized. You don't always write an equation for these things, but that is what is happening. The classic example is the apple orchard, where you get fewer apples per tree the more you crowd the orchard. The optimum solution is given by solving a quadratic equation. In real orchards with real apple trees, it is true that the actual equation may not be the simplified quadratic equation of the iconic high school math problem. But the principle of optimization is the same, and it is the quadratic equation which most clearly and in simple way illustrates this principle.

Perhaps the most important lesson of high school math is that the physical world can be modelled mathematically, and that mathematical equations have solutions. It is possible to simply write out a formula which solves any quadratic equation but this would be wrong. It obscures the basic idea of what it means to solve an equation mathematically. You cannot begin to explain the general solution of a quadratic equation unless you start with the method of factoring. As pointless as it seems when you are doing it, that is where it leads to and that is why you can't teach math without it.

So, what are the latest methods used in factoring quadratics?

The subject of this innovative idea are Berry method, Enholm's method and its 2 categories – basic and intermediate and Box and Diamond methods. These methods will be presented in details and explained. Then worked out in groups by participants. Hands-on papers and other interactive materials will be used, We will start with the Berry method, practicing factorization of quadratics with coefficients a=1, and "a" different from 1. Similar we will introduce the other three methods of factoring quadratics. These methods are very useful for adopting the concept of factoring without using trivial methods as quadratic formula, that needs memorizing, the trial method that needs more cognitive skills. The alternative methods give a powerful tool in the hands of the students with difficulties and stress more on practicing and mechanics of factoring.

## DEVELOPMENT WORKSHOPS

### Problem Based Learning (PBL): Empowering Students to Change The World

*Dania Saad, Ghada Al Jabai, Makassed Islamic High School, Saida, Lebanon*

A large percentage of today's students are eager to use their creativity skills to solve problems. About 42 % of youth in grades 5-12 aspire to develop world-changing inventions. Problem Based Learning (PBL) is not just a way of learning; it's a way of working together. If students learn to take responsibility for their own learning, they will form the basis for the way they will work with others in their adult lives. Schools where PBL is practiced find a decline in absenteeism, an increase in cooperative learning skills, and improvement in student achievement. By bringing real-life context and technology to the curriculum through a PBL approach, students are encouraged to become independent workers, critical thinkers, and lifelong learners. Teachers can communicate with administrators, exchange ideas with other teachers and communicate with

parents, all the while breaking down invisible barriers such as isolation of the classroom, fear of embarking on an unfamiliar process, and lack of assurances of success. Workshop participants will be introduced to PBL through different hands-on activities, case study videos, and ask an expert in order to be able to develop their own PBL.

## 1. Introduction:

PBL appeared more than half a century ago as a practical teaching strategy in medicine, engineering, economics, and other disciplines. Where students are challenged to solve real life problems. This "problem" can take many forms, where it could be:

- A made-up situation, like case study or a scenario
- A fully-authentic real-world problem.
- Taking a stand on an issue
- Answering a "philosophical" question.

In K-12 education, PBL addresses essential content through rigorous, relevant, hands-on learning. Where learning to read is no longer enough, today's students need to be able to sail across and evaluate a vast store of information.

## 2. Strategy:

PBL as a 21st century strategy for education, is typically framed with open-ended questions that drive students to investigate, do research, or construct their own solutions. Although problems are defined in advance by the instructor, they tend to be complex, even messy, and cannot be solved by one "right" or easy-to-find answer. Students use technology in order to communicate, collaborate, conduct research, analyze, create, and publish their own work for authentic audiences. Example Edmodo that is becoming an indispensable tool in many classrooms engaged in PBL, to help with project management and assessment.

## 3. Description of session:

**Ice break activity by using Sticky notes:** to get to know the participants in the workshop and to check the participant's prior knowledge and expectation about PBL.

The responses will be posted on the wall wisher "Padlet".

**Jigsaw Activity:** where the participant will be divided into 3 groups and each group will answer one of the following questions:

1. What is project based learning?
2. Why to use project based learning?
3. How to do project based learning?

**Prepare Participants for Critical Viewing of Case Study Videos**: Before watching the video ask participants, "What questions do you have about good PBL projects that might be answered by looking carefully at a video of students working on a project?"

**Watch Case Study Videos:** After a brief small-group discussion and reflection, engage the larger group of participants in conversation about what they saw. Ideas for post-viewing questions include:

- "What steps did the students take to work on their project?"
- "What objectives did the students meet through work on their project?"
- "What is the role of the teacher in PBL?"

**PBL Experts**: Ask participants, "What do the experts have to say about the effectiveness of PBL activities?"

- Introduce participants to the article "PBL: What Experts Say" on Edutopia.org and by using jigsaw strategy, have the small groups present their findings to the large group.

**Develop a Project:** Ask participants: "What ideas do you have for a project?" Have them create, discus what they will imagine, how they will prepare, and how they will mentor.

**Gallery walk:** ask the participants to walk and check PBL templates done by the other groups.

## 4. Conclusion:

Today's students will face complex challenges when they complete their formal education.

Knowing how to solve problems, work collaboratively, and think innovatively are becoming essential skills. Not only for finding future careers, but also for tackling difficult issues in local communities and around the world.

## 5. References:

*The University of Maastricht has a thorough site of links to information on PBL*
*•The Buck Institute also has a comprehensive set of resources to find more information about PBL.*
*•Stanford Learning Laboratory has a preliminary literature review on PBL.*
***For more information on PBL lessons and problems:***
*•The Classroom of the Future*
*•Schools of California Online Resources for Education*
*•El Dorado County Office of Education*
*If you are a teacher or educator who would like to learn more about PBL methods, here are some ways.*
***PBL courses, workshops and conferences:***

*•Center for Educational Technologies (NASA's Classroom of the Future) provides several on-line references for teachers and students.*
*•The Buck Institute offers a workshop on PBL.*
*•Education by Design offers an online course in Problem-based Learning*
***PBL discussion groups, lists, etc.***
*•PBL Net*
*•University of Delware-PBL in Undergraduate Education list*
*•University Network on Innovative Student-Centred Education*

**The Role of Science Coordinators as Thought-Provoking Catalysts**

*George Rizkallah, Brummana High School, Lebanon*

Everyone agrees that science coordinators are in leadership positions. Consequently, they are expected to move their department members in a way that will align the work of the department with the vision and the mission of the school. But how can this be done? Traditionally, department heads inherit a job description in which they have very little input and routine work seems to fill the departmental calendar, leaving little time for creative changes. So most of the time department heads end up drowning in technical work and stagnancy in the department prevails. But this can be changed. Theories in leadership, clinical supervision and adaptive project planning can help set a new approach to leading a science department. In this workshop, we shall study three activities that can make a small evolution in the work of a department head: (1) the coordinator as a mobilizer of people; (2) the coordinator as a formative supervisor; and (3) the coordinator as an adaptive work planner. Three activities shall be accomplished in the workshop over a period of 90-120 minutes. At the end of which participants will get insights which will allow them to reflect on their current work and possibly introduce some powerful changes.

The workshop is initiated with the following essential questions:
1) How do we lead a science department through the current rapid changes in research and technology?
2) How do we lead when our authority is limited and goals are too broad or too vague?
3) How do we best lead department members?

Also, the workshop will have the following outcomes:
1) To identify key duties and responsibilities of the Science Department head.
2) To provide some tools for Science Department heads on how to mobilize people and deal with resistance to change.
3) To develop a rubric of evaluation about the work of the department head that will be used by the department members at the end of the academic year.

In the first part of the workshop, participants will be engaged in discussions about the following terms: holding environment, how to use authority, how not to use authority, change, mobilizing people, resistance to mobilization, positive outcome of conflict, stress control, stress provocation,

leading through bad news, leading through critical questions, motivating people, technical work as opposed to adaptive work and learning from failures. (30 minutes)
In the second part of the workshop department heads will be exposed to the process of clinical supervision process as outlined by Glickman and Goldhammer ( 30 min). The third part of the workshop will be an exercise where participants will be engaged in developing an action plan over an adaptive work. The last 20 minutes will be used for rubric development.

**Investigating Lab Skills in IB, MYP & DP**

*Mirna Raslan, Reem Halawi, Farah Abed Ali, Wellspring Learning Community School, Beirut, Lebanon*

The International Baccalaureate (IB) program is unique for its inquiry-based approaches in teaching and learning. One of the most challenging student-centered activities in IB are the lab skills acquired by students through the Middle Years Program (MYP) and the Diploma Programme (DP) before going into college. In MYP that starts with grade 6, students are introduced to the basics of a lab report with simple hands-on activities supervised by their teacher. Through completing MYP year 5, students will be able to write a full lab report according to the MYP criteria B & C for assessment. In DP that starts by grade 11, students become more professional in collecting, analyzing and processing their experimental data and ready for their big challenge to complete their internal assessments. As students graduating from IB reach college, they excel in writing lab reports. In this session, participants will be introduced to the lab skills in both MYP and DP. They will have the chance to perform a chemistry and a biology experimental investigation, collect, process and analyze data. Participants will be asked to complete a lab report according to the criteria provided. They will also be asked to compare and discuss lab reports written by students from schools that do not follow IB.

1. **Introduction**: Laboratory investigations as part of the hands on activities done in a science classroom are becoming evident teaching approaches toward a student centered lesson plans. Students get more engaged in this inquiry based activity for a better investigation of the lesson and thus meeting the lesson objectives. Lab skills acquired in the MYP science classes constitute the foundation for preparing students to face the challenges of higher level education. Students who learn Chemistry & Biology through the inquiry approach have the ability to ask meaningful and scientifically sound questions related to their observations and findings in an inquiry-type experiment.

2. **Strategy**: In this session participants will be introduced to the IB program through an interactive power point presentation with the focus on lab skills. The participants will be able to highlight how students are assessed in IB according to both the MYP criteria and the internal assessment criteria in DP. Following the presentation are several Chemistry and Biology activities distributed among the divided groups that will further emphasize the objectives of the session. In the session, participants will be able to identify and pose scientifically oriented questions, form a hypothesis, design and conduct scientific investigations, formulate and revise

scientific explanations and communicate and defend scientific arguments. Those experiences put the student in the center of the learning process.

3.**Description of session**: The participants will be divided into 4 groups (2 groups working on a chemistry investigation and 2 working on a biology one). Two groups will be asked to investigate an assigned research question according to MYP criteria and write a template of the lab report, while the other two will be asked to do the same task but for the IAs criteria of DP. For the chemistry investigation; participants will be working on acid/bases topic. They will be asked to calculate the molarity of an unknown acid using a simple titration (maybe using data-loggers or indicators) Other participants will be working on a virtual lab to investigate the limiting factors that affect the rate of Photosynthesis in Elodea plants using laptops. Participants will have the opportunity to target the same topic whether in chemistry or biology from two different perspectives (MYP & DP) using the same report template.

4.**Conclusion**: In the MYP, 50% of the Science objectives are on designing and conducting scientific investigations. This is almost absent in other middle school programs or curricula with the exception of the I.G.C.S.E. In DP 30% of the final grades on the report cards go for internal assessments. By the end of our session, participants will consider lab skills addressed in IB and integrate as much as possible in the curricula used at their schools. They will be able to sense the difference in the ability of their students to collect, process and interpret data. Participants can provide lab reports from students at schools with non IB programs and even students at higher education and question the possibility of modifying these reports to fit the MYP/ DP criteria.

5.**References**: Biology subject guide for both MYP and DP.

Cambridge IGCSE Chemistry 0620. Syllabus for Examination in 2016, 2017 and 2018. N.p.: CIE.org, n.d. PDF.

"Chemistry Guide." Online Curriculum Centre. N.p., n.d. Web. 29 Nov. 2015. <http://occ.ibo.org/ibis/occ/guest/home.cfm>.

Inquiry in Science Education: International Perspectives." Eva Krugly-Smolska and Peter C. Taylor, Section Editors, n.d. Web.

“Science guide”.Online Curricuum Centre.N.P, n.d. Web 29 Nov. 2015. <http://occ.ibo.org/ibis/occ/guest/home.cfm>.

"The National Center for Educational Research and Development NCERD (1997)." The National Center for Educational Research and Development NCERD (1997). N.p., n.d. Web.

**Enhancing Critical Thinking in Science**

***(Only abstract included for the following session)***

*Saouma BouJaoude, American University of Beirut, Beirut, Lebanon*

Twenty-first century students need to develop critical thinking skills, seek knowledge through questioning, and use this knowledge in novel situations to solve academic and everyday problems. These needs require a change in teaching approaches from disseminating knowledge to helping students analyze existing problems, constructing solutions to these problems, and making these solution available for critique and evaluation. Consequently, the purpose of this workshop is to engage participants in activities that will help them consider the significance of using critical thinking in their teaching.

**Wonder and Inspire**

*Amina Maatouk, Nawal Dali Balta, Makassed-Aicha Om El Mo'minin School, Lebanon*

Working Science requires creative, exciting and innovating activities especially for elementary learners. Our workshop is dedicated to helping educators learn how to develop a variety of science experiments and thought-provoking activity ideas that promote investigation, stimulate questioning, problem solving and kinesthetic learning and strengthen the 21st century skills and the habits of mind. Moreover, it sheds light on the importance of learning by doing to foster deep understanding and create unforgettable and enjoyable learning experiences. Participants will take on the role of cycle 2 learners who will be well engaged in hands-on/ minds-on activities to learn science concepts and new strategies.

Our modern society is faster paced, globally networked, technologically oriented, and requires workers who can solve problems and think critically. Moreover, our 21st Century students will enter a job market that is different from the traditional workplace of the 20th century of their parents and grandparents. They will need to be prepared to ask questions, collect, synthesize, and analyze information; they will need to be prepared to work cooperatively with others to respond to changing social, economic, and global conditions. They will also be using technology to communicate their ideas, thoughts and final products. When students take part in complex and meaningful projects they are preparing for engagement and collaboration that will sustain them in the future workplace. Inquiry based learning allows students to solve problems in collaboration with others; engages them in productive meta-cognitive strategies about their own learning; places some learning decisions and activities in the hands of students; and depends for success on monitoring of student thinking about complex problems and relies on ongoing targeted feedback to students.

The primary purpose of this workshop is to teach participants how to apply inquiry in class through creative activities to develop questioning, 21st century skills, thinking and problem solving skills. It also includes the application of certain specific habits of mind that are necessary for both generating and effectively transmitting the fund of knowledge. Inquiry-based learning increases intellectual engagement and fosters deep understanding through the development of

hands-on, minds-on and 'research-based disposition'. Moreover, the workshop will teach participants new strategies like carousel, gallery walk and share, pair, square.

The session is planned as follows:

(a) Introduction of presenters and participants and expectations of workshop. Each participant will write his/ her name on A4 paper using starchy water and cotton swabs (10minutes);

(b) Participants will watch a video about 21st century skills, then discussion and explanation of these skills using pop up strategy (10minutes).

(c) Presenters shed light on inquiry based learning, its levels, inquiry cycle and forms and the suitable asked questions for inquiry and learn thinking skills, 21st century and problem solving skills (25minutes).

(d) Participants will work in groups to use inquiry based learning in the following experiments: (20minutes)

1- Refraction: they use a jar of water and colored cardboards to discover the refraction concept; then presentation of their work, think, pair, square share strategy is applied.

2- Mystery Pitcher: they use Phenolphtalein solution, sodium carbonate, vinegar, 4 glasses, pitcher and water to explore the role of indicator; then apply the carousel strategy.

(e) Discussion and explanation of habits of mind that can be developed by inquiry based learning. (20minutes)

(f) Participants will work in groups to use inquiry and apply the habits of mind through the following activities: (20minutes)

3- Scribbling Machine: they use coloring crayons, rubber band, small empty labneh box, motors 3v, batteries 9v, small cloth pins, masking tape, cardboard to explore the electric circuit, gallery walk strategy is applied.

4- Invisible Ink (Secret letter): they will use cotton dipped in iodine solution to reveal their names on the papers they wrote their names on, in the beginning of the workshop to identify the presence of a chemical change.

(g) They use the give one / get one strategy to develop new ideas about the use of these activities in their classes. (5min)

(h) Conclusion: Discussion about the importance of inquiry based learning to engage students in doing and understanding science, asking good questions and thinking skills, developing skills and applying the habits of mind. (5minutes)

(i) Evaluation of workshop (5minutes)

Teaching science through scientific inquiry is the cornerstone of good teaching especially for elementary students who cannot wait for the teacher or someone else to provide an answer —

instead, they are actively seeking solutions, designing investigations, and asking new questions. They learn to think and problem solve. They learn about the habits of mind and that there is no one place or one resource for answers, but that many tools are useful for exploring problems. Students are actively involved in making observations, collecting and analyzing information, synthesizing information, and drawing conclusions to develop useful problem-solving skills. These skills can be applied to future "need to know" situations that students will encounter both at school and at work.

**Some references:**

http://www.thirteen.org/edonline/concept2class/inquiry/
https://www.learner.org/workshops/inquiry/resources/faq.html
http://www.hometrainingtools.com/a/color-change-magic-trick-project

## Integrating Math in Today's Classrooms: Problem Philia Instead of Problem Phobia

*Hammam Serhal & Julie Balhawan, Le Lycee Nationale, Lebanon*

The main purposes of this session are to discuss:

1. how to avoid abstractness in teaching mathematics
2. how to engage the students in reading especially word problems in cycles I and II through the integration of mathematics in other subjects like environment, society and students interests.

After the workshop, teachers are expected to start using more integrated problems along with other kinds of classical problems.

**The flow of the session:**

First part: 15 min.

Introduction about the importance of integration of mathematics as a tool to avoid theoretic and classical problems to enrich student abilities and skills behind comprehension and applications. Moreover, problem solving in teaching mathematics in 2016 must include many differences in the epoch of Social Media, Communications and Informatics. It is unbelievable not to make use of the huge searching engines in our planning, preparations and integrations.

**Second part: 15 min.**

Hands-on activity sheets providing examples about problem solving for different classes that integrate mathematics in other subjects , environment, society and student's interests as applications to specific topics in Lebanese curriculum.

**Third part: 60 min.**

This part will be specified for applications. After choosing a grade and a concept in the math curriculum, the audience is supposed to be distributed in groups to make a guided search on the

Internet for specific information to create their own problems that integrate mathematics in our three topics.

**Fourth part: 30 min.**

In this part we are going to brainstorm the group's results and the difficulties they faced in finding or selecting the information from the Internet and their reliabilities. After the groups present their work and their outcomes, a discussion and feedback will be given by the presenter.

## The Ambiguous Role of Figures in Geometry: Are Teachers Aware? Are They Ready?

*Badera Nakouzi, University of Saint Joseph (USJ). Beirut, Lebanon*

### Introduction

We always wonder why teachers deal with complex teaching situations in different ways, and why their teaching practices and approaches vary a lot. In fact many factors might influence the way teachers teach and the efficiency of their teaching. These factors might be grouped in two categories: the personal characteristics such as gender, age, personality, or the teachers' experiences in education which relate to what and how they were taught and the pedagogical preparation they received (Cruickshank, Bainer, & Metcalf, 2012). Since it is hard to alter some of these factors, educators care the most about teachers' experiences that can be manipulated in the intention of improving teaching. It is always said that "we teach as we were taught". If this is true, then teachers are faced with lots of challenges to be able to extract themselves from the limitations of their inherited experiences. Moreover, teachers' preparation programs must expose teachers to new experiences to reflect on and make use of. This will help them to cope with the new trends of teaching and to be able to deal with many complex teaching situations they can face in their classrooms.

One of the complex situations that teachers face while teaching geometry is how to deal with the ambiguous role of geometric figures. Padilla (1990) considered that what we can see from the figure is a complex process and it is a part of learning that must not be ignored. Throughout history, geometry developed from being the study of actual physical entities dealing with them empirically, to the idealization of spatial and quantitative realities dealing with them deductively (Harel, & Sowder, 2007). The study of geometry in schools proceeds in a manner that is similar to the development of geometry throughout history. Young children are introduced to geometry through the exposure to real physical objects. They participate in activities such as describing, grouping, differentiating, manipulating, or matching these objects with 2D representations. During the upper elementary level, students are expected to idealize the geometrical objects. They are expected to identify or represent these objects by drawings, but they use perception or measurement tools to recognize their properties. In the middle school, logic and deduction are the only accepted mode of verification of geometric assertions and students are expected to differentiate among the qualitative and geometric properties of the drawings.

In this respect, Gobert (2007) found that students are contingent to the study of geometry, especially the drawing that is considered like the workplace (milieu) in this discipline. Students consider the drawings as an object in the sensible space and they have difficulty in going beyond the actual perceptual or instrumental perspectives. This view regarding the knowledge of the

geometrical properties forms an obstacle for the entry of students in the mathematical debate that prepares student for the demonstration. According to Gobert, for students to have a good geometrical understanding, it is essential for teachers to make explicit some basic knowledge. One of them is the comprehension of what a geometric figure is through the distinction between 'referent' and the diversity of drawings it represents. Another one is concerned about the categorization of geometric properties related to the figure and the distinction among geometrically meaningful information on the drawings and the geometric properties related to the referent. These have to be complemented by the choice of verification of responses that is related to the different teaching contracts used at different levels.

Lots of researches in this field showed that many teachers are not aware of the essential knowledge that corresponds to the true understanding of geometry, and to the clarification of the role of the figure in geometrical thinking. On the other hand, most mathematics curriculums do not include the objectives that emphasize on making this knowledge explicit. Even if teachers are aware of this issue and decided to make it explicit, they might not know what is the best approach to use. Review of some teachers' practices in the geometry classrooms in Lebanon showed the dominance of traditional teaching strategies that implement mainly direct approaches. This might be due to the fact that teachers are not experienced in the creating didactical situations that can help their students acquire basic knowledge in order to enhance their learning.

**Strategy:**

Participant in this workshop will be taking part in hands-on activities, as well as, interactive discussions. They will be required to reflect on their own teaching experiences in the geometry classrooms. Moreover, teachers will be introduced to didactic situations following the model of Brousseau (2002) in which they will be expected to take the role of the students to ensure the maximum involvement and benefit. The aim of this session will be to give participants the chance to:

- Identify the basic role that the geometric figure plays in geometric understanding.
- Recognize the difficulties that students face while dealing with geometric and visual information.
- Relate these difficulties to Gobert's basic knowledge.
- Define basic terms used in geometry that are related to the figures.
- Differentiate between particularities and generalities on the drawings.
- Differentiate among spatial, geometrical, and visual information.
- Experience a learning- teaching (didactic) situation that will enhance the acquisition of the knowledge mentioned above.
- Create their own situations that can enhance student's learning.
- Come up with recommendation that can help teachers in their classrooms.

**Description:**

The session will be planned as follows:
(a) A brief introduction to highlight on the importance of the topic (10 min), (b) Participant will be answering questions related to their understanding of the ambiguous role of the figures in geometry and regarding the practices they use in their classrooms while dealing with it (15 min), (c) Collect answers and come out with different roles of figures (10 min), (d) Participant will be required to individually represent a 3D real physical geometric object (10 min), (e) Analyze in

groups the drawings obtained to differentiate among two categories of information 1) spatial, geometrical, and visual information, 2) generalities vs particularities information on drawings (15 min), (f) Present a didactic situation in which participants will take the role of the students (25 min), (h) Reflect on the situation given and try to suggest other situation that can be beneficial in this case (20 min), and (i) Sum up and allow for questions (15 min).

**Conclusion**

It is always said that Mathematics is hard to teach, and students always complain that learning mathematics is difficult. In this regard, it is helpful to try to analyze students' difficulties, and to look for the best teaching approaches that can facilitate student's learning and acquisition of certain skills. The role of the figures in geometric understanding is complex, and usually its study is not included in the teachers' preparation programs. This might require the teachers' awareness of the issue and the involvement in experiences that can help them cope with such situations.

**References**

Brousseau, G. (2002). Theory of Didactical Situations in Mathematics. Kluwer Academic Publisher, New York.

Cruickshank, D., Bainer, D., & Metcalf, K., 2012. The Act of Teaching, Sixth edition. Mc Graw-Hill, New York

Gobert, S. (2007). Conditions Necessaires A L'Usage Des Dessins En Geometrie Deductives. *Petit x, 74*, 34-59.

Padilla, V. (1990). Les figures aident- Elles a voir En Geometrie? *Annales de Didactique et de Science Cognitives, 3*, p.223-252, IREM de Strasbourg

**Driving a Culture of Thinking in an Inclusive Classroom**

*Dana Dimassi, Rasha Osseily, Eastwood College, Mansourieh, Lebanon & Rola Accad, LWIS, Hazmieh, Lebanon*

Creating a culture of thinking in an inclusive elementary classroom requires consideration of many factors that allow students to visualize their thinking. Some of these factors, or forces, as described by Ron Ritchhart in his book "Cultures of Thinking", are the physical environment, language, learning opportunities and Thinking Routines. The use of Thinking Routines as a tool will challenge, elevate and visualize student thinking in an integrated inclusive classroom. This workshop will discuss the true meaning of thinking in relation to learning and the role of teaching in uncovering this skill in students through the use of Thinking Routines and awareness of cultural forces. These forces also allow the learning to be differentiated by nature. Attendees will experience first-hand what it means to be a thinker, deepen their own understanding of thinking and learning, and the forms of differentiation that will support a thinking culture in their classrooms.

Making Thinking Visible is a teaching and learning approach developed by Project Zero at Harvard Graduate School of Education to facilitate students' deeper understanding of their learning experiences. This approach enhances students' engagement and independence through

the development of their meta–strategic and meta–learning knowledge. Making Thinking Visible argues that understanding is not the precursor to application, analysis, synthesis, evaluating and creating but rather a result of it. Also, thinking is at the center of the learning enterprise and not a mere add-on. It is through visualizing thinking by considering many factors, such as the environment and language, that teachers promote thinking skills, deepen understanding of content, and differentiate learning. Hence, a classroom's culture of thinking is created and must be fostered.

**Strategy**
Thinking Routines are used to promote a culture of thinking by making thinking visible. These routines are used as patterns of thought. They operate as tools for promoting thinking, and are crafted to support and structure students' thinking. Thinking Routines are goal oriented in that they target specific types of thinking, they support individual and group learning, are easy to teach and learn, and can be used across all grade levels and content. Thinking Routines are also helpful for students who present learning difficulties or who are low achievers. Visible thinking works from the idea that intellect is developed and demonstrated. Using thinking routines, students are expressing their thinking and understanding and not being faced by providing a correct answer, as there is no right or wrong answer.

**Description of Session**
**Objectives:**
• Define thinking
• Acknowledge the relationship between thinking and learning
• Appreciate a culture of thinking by creating and fostering the elements that promote thinking (environment, language, learning experiences)
• Understand the form and function of Thinking Routines
• Use Thinking Routines to create and support a culture of thinking
• Use Thinking Routines to differentiate teaching and learning

**Materials:**
• 5 Continua for Assessing Thinking Sheet: http://pzartfulthinking.org/wpcontent/uploads/2014/09/AT_Five-Continua.pdf
• Video Brain Power 3 of 6: https://www.youtube.com/watch?v=pyYB64qsXIk
• Thinking Routine: "I used to think… Now I think…" handout
• Thinking Routine: "Step Inside" handout
• Thinking Routines List
• Markers
• Chart Paper

**1. Introduction to Thinking [20 minutes]**
Instructors will moderate a discussion to elicit attendees' background knowledge on thinking and identify signs of it in their classrooms. Attendees will conclude that thinking is the purposeful mental activities. The discussion will focus around the 8 cultural forces that enhance thinking: time, opportunities, routines & structures, language, modeling, interactions & relationships, physical environment, & expectations. Attendees will use the thinking routine "I used to think… Now I think…" which will help them reflect on their thinking about the definition of thinking

and explore how and why their thinking changes as learners. For this part of the session, attendees will only complete the sentence "I used to think…".

**Modeling a Culture of Thinking [45 minutes]**
Divided into 3 teams, every team will assume the role of one system of the human body as follows:
Team 1: Nervous System
Team 2: Muscular System
Team 3: Digestive System
Instructors will explain the Thinking Routine "Step Inside" that will help them investigate the following big question: How the body systems respond to the natural instinct of survival?

**Step Inside Thinking Routine:**
Teams will place themselves within the body system they have assumed to be.
Then they will answer the following questions:
- What can this body system see, observe, or notice?
- What might this body system know, understand, hold true, or believe?
- What might this body system care deeply about?
- What might this body system wonder about or question?

In their teams, attendees will answer these questions on a big chart paper, as reflection on the video they watched, and using their prior knowledge.
Assuming these roles, attendees will watch a video of a man who gets stuck in a cave for 35 days with no food. They will observe how his body responds to starvation as days pass by with attention to the function of the body systems.
3 stations will be set up that will support learning styles. Attendees will be working on those stations to investigate:
Station 1: Books & pictures about the body systems
Station 2: Songs and audiovisuals about the body systems
Station 3: Crafting & Modeling Materials

Meanwhile, instructors will be touring around, listening to attendees' thinking, questioning their thoughts, and challenging their learning. Teams will share their findings. They will conclude that body systems are interdependent and interrelated.

**Reflection on Learning [15 minutes]**
Attendees will discuss this learning experience and share their findings using the following guiding questions:
- How do you notice differentiation taking place in such a setting?
- What signs of cultures of thinking did you notice?
- How did the thinking routine support the thinking forces in the classroom?

**Taking Learning Further [30 minutes]**
In teams, using the list of Thinking Routines, attendees will create a learning experience of a topic of their choice with a focus around fostering a culture of thinking in the classroom. They will get the chance to present their plan and receive feedback.

**Conclusion [10 minutes]**
Q&A
Complete the "I used to think… Now I think" Thinking Routine by completing the "Now I think…" statement.
Attendees will plot their own thinking skills on the 5 Continua of Assessing Thinking.
To foster a culture of thinking in a inclusive setting.

**References**

• Website: http://www.visiblethinkingpz.org/
• Book: Cultures of Thinking by Ron Ritchhart
• Book: Making Thinking Visible by Ron Ritchhart, Mark Church & Karin Morrison
• 5 Continua of Thinking: Artful Thinking | Project Zero, Harvard Graduate School of Education


## Understanding Dyscalculia


*Aya Wehbi, Houssam Eddine Hariri High School, Saida, Lebanon*


Learning difficulties have been a great concern for researchers and educators these past 10 years. The prevalence of learning difficulties has increased and is expected to show more increase in the years to come. In addition to that, students having learning difficulties are mostly being integrated in the classrooms of most schools. For this reason, every educator has to have the complete knowledge and awareness of these difficulties and disabilities in order to deal with the different cases that might come their way.
During this workshop, we will be talking about the different types of learning difficulties, and we will then move on to specifically handle a type of learning difficulties called the "Mathematics Learning Difficulty" or "Dyscalculia". Dyscalculia affects a person's ability to understand numbers and learn math facts. Accordingly, participants will be put in the shoes of learners with learning difficulties and dyscalculia through a number of interactive and goal-based activities. They will also learn how to identify a dyscalculic person and discuss the learning strategies used in teaching a learner having dyscalculia.
**Description:**
During the workshop, participants will be seated into 5 groups. Each group may consist of 5 to 6 members.
The flow of the workshop is prepared on a power point presentation in addition to different tasks and activities as detailed below**.**
**Task 1:**
After discussing the significance of learning difficulties nowadays and its wide spread in our community, each group will be given the time to discuss the conditions that cause a student to be a low-achiever. **(10 minutes).**
After collecting every group's answers, the presenter lists the different conditions and classifies them as "difficulties" and "disabilities" and emphasizes on how to differentiate between each. The presenter will then give a common terminology and definition to define learning difficulties and disabilities. **(10 minutes)**
**Task 2: "Putting Ourselves in Their Shoes" (25 minutes)**
Four numbered envelopes will be distributed randomly. Each envelope includes a task related to one of the following:

1. Input: "Visual and Auditory Perception"
2. Output: "Language and Motor Skills"
3. Storage: "Memory"
4. Integration: "Interpret, Sequence, Generalize"

This activity allows participants to put themselves in the shoes of a person having learning difficulties. It also helps them understand the four brain developmental sides causing a learning difficulty LD.

After understanding the significance and identification of LDs, participants will now be introduced to the specific Math learning difficulty "Dyscalculia".
We will discuss its definition, percentage of occurrence, causes, relation with other LDs, and its characteristics in early stages. **(10 minutes)**

**Task 3: "Trying to Feel Numbers" (25 min)**

After knowing that Dyscalculia is a learning disability that makes it hard to make sense of numbers and math concepts, each group will be given a different activity to work on. And after that, each group will present his own product. This interactive and fun activity will help participants understand and conclude how to identify a dyscalculic person.
The activities are as follows:

1. Numbers and Memory activity: Memorizing the phone numbers of the members in the same group
2. Counting activity: Counting dots and measuring the time taken to count them
3. Calculation activity: Performing certain mathematical calculations
4. Spatial activity: Giving directions
5. Measurement activity: Giving estimated measures of different items

**Task 4: "Checking Math Disabilities" (10 minutes)**

A checklist about math abilities will be distributed to the participants. They are asked to check their own math abilities.

Finally, the presenter will discuss the strategies used with dyscalculic learners and the multi-sensory approach that helps them learn better. **(20 minutes)**
Participants will be provided with handouts summarizing the whole presentation.

## Inclusion… A Policy in Practice

*Reem Al Hout, American Academy of Beirut, Beirut, Lebanon*

In this workshop we intend to enhance inclusion in schools as a policy, system, strategy and classroom practices. Participants will be seated in six groups. Each group will present one of the "Thinking Hats" and will share their ideas about inclusion in terms of "process, facts, feelings, creativity and benefits" (10 min). After building background, together we derive a definition for inclusion that is practical and achievable in schools. With the audience, derive the inclusion perspective from their point of view, then make consensus upon that (10 min).

Briefly introduce some categories of special educational needs (5 min):

- communication and interaction needs
- cognition and learning needs
- behavior, social and emotional needs
- sensory and/or physical needs
- medical conditions
- gifted and talented.

and common types of learning difficulties encountered in classrooms (5 min):

- attention deficit hyperactivity disorder
- dyslexia
- asperger syndrome
- dyspraxia
- dyscalculia

Explore ideas of access and engagement as main indicators of inclusive practices in schools. Have participants discuss in three groups the barriers against access and the other 3 groups the barriers against engagement and have them share their ideas from their present situations in schools. Use a check list to assess the level of access and engagement present in the different schools (15 min).

An overview of the social and medical models of inclusion will lead audience to understand the underlying differences between them that influence their present inclusive practices (10 min). Present the different learning styles and strategies to differentiate instructions in classrooms to accommodate and facilitate the learning of SEN students. Have participants do a learning style checklist to comprehend and appreciate the needs of the SEN students (15 min).

Introduce the "Response in Intervention (RIT) Framework" with its three tiers or levels. Have each two groups fill the framework with respect to academic, behavioral and social-emotional interventions on flip charts. Share the information in a museum style around the room (15 min).

I will share my personal experience at an inclusive school and the application of the social model and the multi track approach applied and practiced. Furthermore, I will brief the audience with the different barriers for access and engagement that were faced and how we could overcome most obstacles in terms of policy, culture and practice. I will indicate the role of the policy makers in empowering the staff members, and the administrators through inclusion conferences, trainings and workshops as well as the online courses (10 min).

As a wrap up for the workshop, participants fill out an inclusion audit sample that reflects conditions in their schools and an action plan that takes a further daring step toward access and engagement of SEN students. Selected volunteer participants will share their plan as an outcome of the workshop (15 min).

## Integrating Math and Sciences Through Real Life Projects

*Hala Tayyara, Nadine Hamawi & Rania Zeid Saad, Eduvation School Network, Lebanon*

This workshop will focus on the approach of utilizing real-life situations in the classroom as integrated projects in math and science. It will present a holistic approach to education where learners will learn life skills, critical and analytical thinking and values through integrated projects. It will focus on an approach that considers math and science (among other subjects) as a unified field of learning, in contrast to the traditional view of them as separate disciplines. This workshop aims at providing teachers with tools to use in order to develop learners' sense of scientific research, innovation, and ability to learn from real life experiences and to transfer what they learn to real life situations.

### I. Introduction:

We are currently experiencing constant and dynamic developments in our immediate vicinity and in the world as a whole. These rapid changes affect and influence various aspects of our lives including teaching and learning. Thus, there is a vital need to constantly update, upgrade, evaluate and reflect on our educational methods and practices. That said, it becomes evident that in addition to educational reforms, there is also a need for continuous professional development for educators. Teacher training is one facet of teachers' professional development; it may be the most commonly used because of its direct implications and effectiveness regarding acquisition of new skills.

In our proposed training session, the discussions will aim at achieving a clearer understanding of how learners learn and how they acquire new skills by using integrated lessons. It can be argued that learners will achieve sustainable and productive learning experiences if 1) instead of telling them how things work, we let them do the work and 2) if these things and work are related and relevant to their everyday life experience.

In real life, concepts, ideas, objects, devices etc. are multifaceted. Producing them involves understandings and skills from various fields of knowledge. They also involve humanistic dimensions since they are used by us according to our values. In other words, real life utilities can be considered as products of "integrated projects" and can only be understood holistically, especially since we aim, through our educational approach, to prepare learners for life.

The session on "Integrating Math and Science" will focus on developing relevancy and applicability of the existing disciplines to the learners' experiences in the form of authentic integrated projects brought from real life to the classroom instead of producing artificial integrated models. In other words, Math and Science will not be approached as separate disciplines, studied and applied separately. The purpose is to prepare the learners for life by helping them learn about real life situations and objects.

Traditionally, integrating Math and Sciences means linking these two disciplines together. Sciences (Life Science, Chemistry and Physics) use Math as a tool to solve scientific problems, do calculations, draw graphs or solve genetic problems. In some cases, Math uses Science examples and applications to explain an abstract mathematical concept in order to raise the interest of learners in Math and its utility. However, integrating Math and Sciences using an integrated project taken from real life situations will enhance learners' critical thinking skills since learners will recognize the interrelationship between the different disciplines and the practical utility of these disciplines in their real lives. In addition, integrating values becomes imperative since we can only truly understand our lives when we see it holistically.

In order to properly implement this approach, we believe that preparing teachers through training on preparation of plans is crucial before their implementation in the classroom. Furthermore, since Math and Science teachers are usually specialized in each discipline separately, they are in need to prepare together for such integrated projects for successful implementation.

**II. Strategy:**

The session will focus on training teachers to implement integration through real life examples by involving the teachers in preparing integrated lesson plans during the session.

**III. Description of the session:**

This session will be divided into four main parts.

1. A brainstorming and inquiry driven discussion where teachers share their experiences and current methods used to integrate Math and Science. The discussion will focus on whether these methods are effective and efficient and suggestions on how improve their effectiveness and efficiency.

2. Presenters will present an example of a type of integration where a real life example is used and linked to the curriculum in order to show learners the applicability of Math and Sciences in their everyday life; in addition, develop an understanding that in real life application of knowledge there is no separation between the disciplines (Math, Science, values etc.). The example that will be presented is water purification. Water purification for drinking purposes is an authentic real life problem that involves a vital need by humans. It can motivate learners to inquire about problems affecting society as a whole, like water pollution and our roles and responsibility. It is connected to content areas such as Chemistry, Physics, Biology and Mathematics. Most importantly, many values can be discussed and learned while implementing the project.

3. Participating teachers will then be asked to do a group activity where they will prepare a lesson plan for an integrated project taken from real life situations. A format for the planning will be provided in addition to several suggested situations. The teachers can choose to modify the format and, preferably, choose

other situations to use for their lesson plan. This group activity will be a kind of training for the participants to prepare plans for integrated projects using the themes taught in Math and Sciences (Life Science, Chemistry and Physics) in a specific class from the Intermediate or the Secondary level. Each group will be formed from Math and Science teachers that teach the same grade level. The group will choose one term of the scholastic year, brainstorm the Math and Science concepts taught in that term and try to create an integrated project.

4. Finally, the participants will be provided with resources to take with them for further references and development.

- **Conclusion:**

  We are preparing our learners for life. We are preparing them to be standup citizens, good parents, leaders in their fields and even trendsetters. These objectives can only be accomplished by adopting an approach where all aspects of the learners' life is taken into consideration and integrated into their education. In addition to this, we should train learners to see and understand situations from different angles and be able to perceive the relevance and intricacy of these situations. Such an approach will prepare learners to become critical thinkers who can analyze complex situations and view the world as a system with each part influencing the other.

This is why integrated projects play a major role in education. Moreover, integrated projects that are based on real life situations and objects have effective and long lasting learning experiences for our learners. Finally, training teachers to apply this approach is needed to achieve the educational outcomes mentioned.

**Climate Change in the Classroom: Training for Secondary Teachers on The UNESCO Course on Climate Change Education for Sustainable Development**

*Sulieman Sulieman, Programme Specialist: STV, UNESCO, Lebanon & Mona Betour El Zoghbi, Environmental Consultant/Expert, Lebanon*

This workshop aims to build the capacity of math and science teachers at the secondary level to teach students about the complex and multi-dimensional aspects of global climate change using a simplified, clear and confident approach. The workshop is based on the UNESCO Resource Kit 'Climate Change in the Classroom', a six-day teacher education program on climate change education. The workshop focuses on training the teachers on the use and application of this Resource Kit in their daily teaching practices with their students inside and outside the classroom. The workshop will first introduce to the teachers the UNESCO's Global Action Programme on Education for Sustainable Development (GAP-ESD) and the 'Climate Change in the Classroom' Resource Kit, focusing on its importance for supporting teachers and building their capacities with regard to climate change education. This will be followed by three sets of interactive and hands-on group activities for applying the various teaching techniques and activities of the Resource Kit. These activities will focus on training teachers on innovative and

student-centered teaching techniques and methods addressing the local impacts of climate change, the importance of envisioning positive futures, and the actions and practices that students can take in their daily lives to feel more empowered and to respond to the challenges of climate change in positive ways.

**1. Introduction:**

This workshop targets math and science secondary teachers to build their skills in teaching about the complexity of global climate change in a simplified and confident approach. The aim of the workshop is to train science and math teachers at the Secondary level on the application of the UNESCO Resource Kit: 'Climate Change in the Classroom', a six-day teacher education program on climate change education. This development workshop is designed to train teachers on the application of this course inside and outside the classroom, in order to enhance their knowledge, skills, and confidence in teaching their students about the causes, impacts, challenges and solutions to climate change. The workshop will therefore address the science of climate change as well as the complex multi-dimensional (social, economic, ethical, political dimensions) aspects of climate change in ways that are relevant to their specific teaching subjects. It will help strengthen teachers' capacities in providing students with more accurate information about climate change, and establishing links to the local country context, as well as building the students' skills and encouraging them to take action on climate change in their daily lives. The workshop is based on the Global Action Programme on Education for Sustainable Development (GAP- ESD), which seeks to advance policy and mobilize resources for re-orienting education towards a pathway that would accelerate progress towards sustainable development.

The workshop will use dynamic, interactive, and participatory approaches to help teachers understand climate change as well as learn how to use the Resource Kit. It will also introduce the teachers to innovative teaching and learning techniques that they can use to equip their students with the necessary skills and practices for managing the impacts of climate change. The Resource Kit has recently been translated into Arabic, and this workshop will use both English and Arabic language strategies.

**2. Strategy:**

The workshop strategy will use both thematic learning as well as practical and hands-on learning approaches. The thematic aspect of the workshop will focus on improving the teachers' understanding of key climate change concepts and of the importance of climate change education for sustainable development, through focusing on understanding key themes and terminologies such as global warming, mitigation and adaptation, and their specific application or relevance to the local national and regional context of Lebanon and the Arab region. The practical aspect of the workshop will train the teachers on the use and application of the teaching and learning methodologies, tools, and activities in the Resource Kit. Both the thematic and practical aspects of the workshop will be based on interactive and participatory group activities and discussions.

**3. Description of the Session:**

The Session will start with a brief presentation on UNESCO's Global Action Programme on Education for Sustainable Development (GAP-ESD) and the 'Climate Change in the Classroom' Resource Kit. This will be followed by a set of group discussions and activities based on the Resource Kit in order to build the capacity of teachers in using and applying this Kit to integrate the concepts and practices related to climate change and sustainability into their classroom teaching.

The session coordinators include STV Programme Specialist at UNESCO-Beirut, CCE experts from the Hashemite University (Jordan) and from the American University in Cairo (Egypt), and UNESCO environmental consultant (Lebanon).

The order and details of the workshop activities are the following:

**ACTIVITY 1: Introduction to the workshop, GAP-ESD and the Resource Kit (15 minutes)**

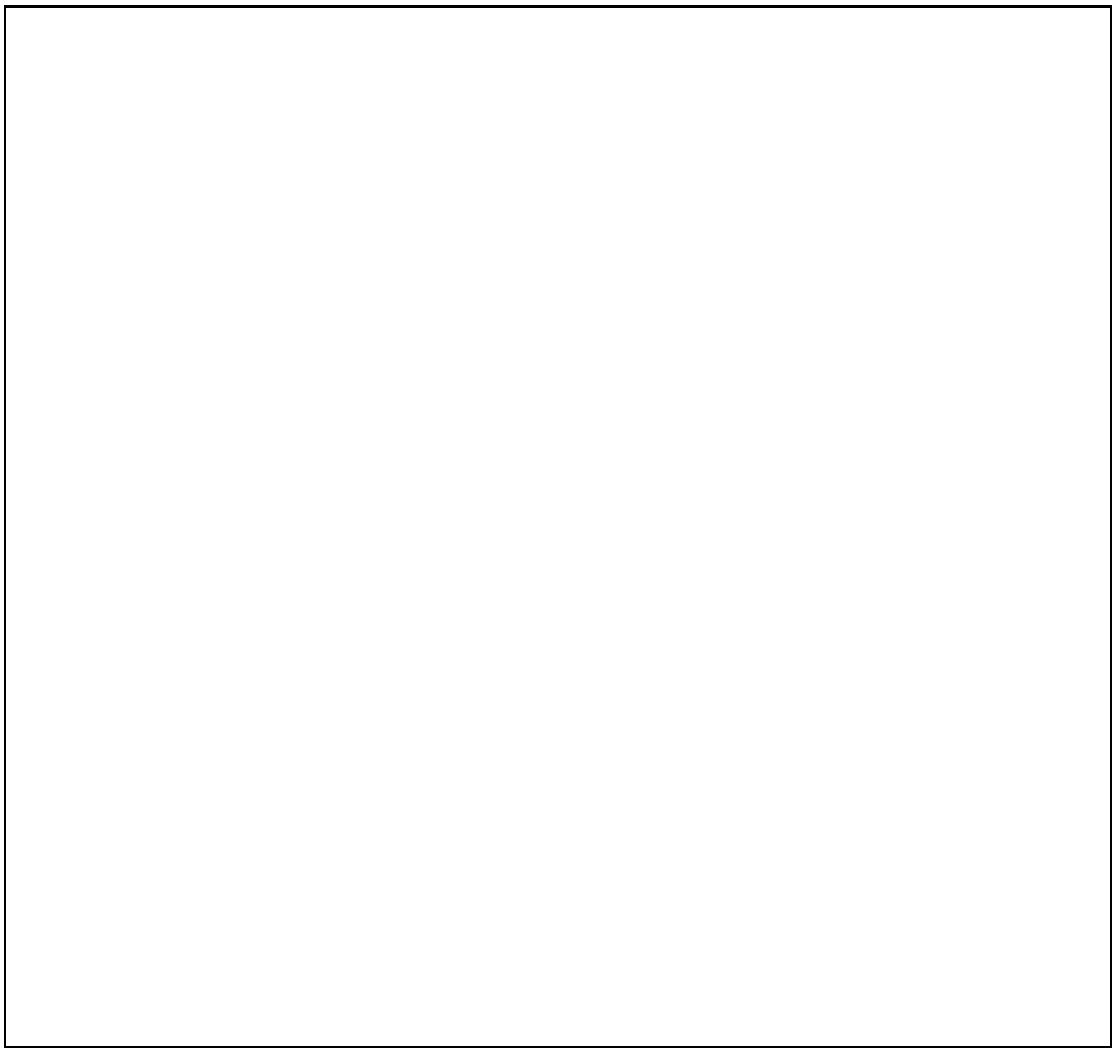
Order of Activity: Facilitators explain the aims and approach of the workshop, and introduce UNESCO's GAP-ESD priority areas and Climate Change in the Classroom Resource Kit.
Participant Involvement: Interaction on power-point presentations and group discussion-questions on the main topics of the workshop.

**ACTIVITY 2: Interactive, participatory, and hands-on exercises on climate change education (90 minutes)**

Order of Activity:

- 2.1. Climate Change Learning: A Local Focus: group activity for the teachers to learn how they can teach about climate change through focusing on local community impacts and risks of climate change (30 minutes);
- 2.2. Climate Change: A Futures Learning Approach: group activity for the teachers to explore teaching and learning with their students about climate change across time, especially the present and the future (30 minutes);
- 2.3. Confronting Climate Change: Towards Empowerment and Action: group activity for the teachers on ways to elicit their students' concerns about the future and to transform feelings of fear and powerlessness in the face of climate change into feelings of positivity and empowerment (30 minutes).

Participant Involvement: Facilitators group participants into teams;
Group discussions and activities.



**ACTIVITY 3: Whole-group discussion and Q&A session, Evaluation- 15 minutes**

Order of Activity:

-Whole-group discussion and Q&A session on the diverse tools and techniques for teaching climate change in the science and math classroom;
-Participants interactively test and apply these tools and techniques with each other;
-Facilitator explains the usefulness of these techniques and ways to determine optimal methods and opportunities for applying them in class.
-Facilitators wrap-up the discussion and provide participants with a CD of the 'Climate Change in the Classroom Resource Kit' and with additional documents and materials containing references and links to handbooks, tools, web-links and activities on climate change and sustainability education

Participant Involvement: Group discussions and activities**;** participant attainment of further learning resources (CD and material).

**4. Conclusion:**

This workshop builds the capacities of math and science educators in Secondary classrooms to teach their students about the causes, impacts, and response strategies to climate change at a local and global level in a simplified approach that does not overwhelm, overcomplicate, or confuse the students with regards to this complex global issue. The workshop enhances the teachers' understanding of the concept of climate change and of the application of climate change education in the classroom and integration into their teaching subjects. The workshop approach and strategy can also be relevant for teachers in other disciplines and subjects such as Arts, Literature, Geography, and other subjects, as well as for teachers in other school levels such as Intermediate. Any similar workshops or applications of this Resource Kit must be tailored to the relevant teaching subject and the educational level of both the teachers and the students.

**5. References:**

UNESCO (2014). Aichi-Nagoya Declaration on Education for Sustainable Development. Nagoya, Japan.

UNESCO (2013). Proposal for a Global Action Programme on Education for Sustainable Development as Follow-Up to the United Nations Decade of Education for Sustainable Development (DESD) After 2014.

UNESCO (2013). Climate change in the classroom: UNESCO course for secondary teachers on climate change education for sustainable development.

UNITAR (2013). UN CC:Learn. Resource Guide for Advanced Learning on Integrating Climate Change in Education at Primary and Secondary Level. United Nations Institute for Training and Research.

**Writing-to-Learn in Science through Genre-based Pedagogy**

*Tamer Amin, Department of Education, American University of Beirut*

In the early elementary years, a great deal of focus is given to developing children's basic literacy skills of reading and writing. They are expected to learn the skills of reading and writing. In the upper elementary years and beyond, students begin to use the skills of reading and writing *in order to* learn; literacy becomes a *tool* at the service of learning. But much of the texts students are expected to read and write become increasingly specialized in the different content areas. Science is no exception. Writing-to-learn in science is particularly challenging because the organization of the different genres of scientific texts students are expected to produce and the words and sentence structures they must be proficient in become increasingly sophisticated. This workshop will introduce science teachers to genre-based pedagogy in science, an approach designed to meet these learning challenges.

## INNOVATIVE IDEA SESSIONS
## 2:30 – 3:45 pm

**The Language Barrier: Early Childhood explorations in a Non-Native Language**

*Hiba Bayloun, Adduha High School, Beirut, Lebanon*

It is known that students are very curious about the world and how it works. They use language to express their ideas and thoughts. As they grow older, they start questioning everything! In what language can they question and express their ideas? Can language be a barrier? A general overview will be shared on a study on the differences among Lebanese students who learned science in native language versus Lebanese students who learned science in a foreign language. Participants will have the opportunity to write and reflect on bilingual lessons. They will also engage in activities exploring ways to support children's scientific analysis and thinking in a new

language. Moreover, presenter will share different recommendations for more effective ways to teach science while taking into consideration language.

**Introduction**

Science plays a vital role in our daily lives. It is based on understanding of scientific concepts and principles from around our world. Students are known to be curious about the world and how it works. Students use verbal and non- verbal language to express that curiosity. As they grow older, they start questioning everything! In what language can they question and express their ideas and thoughts? Can language be a barrier?

In spite of the large number of studies that discuss the influence of language on students' academic performance, there are relatively few investigations on the effect of language on scientific topics like mathematics and science. According to Wellington and Osborne (2001), "almost all teaching and learning takes place using the medium of language, verbal and non-verbal." (p.98). The implication here is that language is associated with the individual's conceptual understanding of a concept within a specific content area. In multilingual societies, as in the case of Lebanon, children follow a curriculum that focuses on more than one language.

The primary purpose of this session is to examine the study about the difference in students' understanding of science topics through learning concepts & terms in native and foreign language. It will examine the relationship between two significant factors: Language proficiency, acquisition and understanding of scientific concepts. In the study, data was obtained through the use of a parent questionnaire, pre- and post- test and classroom observation. The study was conducted on 2$^{nd}$ grade students in a middle class private school in Lebanon. Results indicated that the choice of language has a critical effect on students understanding.

**The session is planned as follows:**

A. **Introduction/warm up activity:** Participants will be asked to create their own organizer about the relationship between learning a language and learning science. (10 minutes)

B. Participants will present their work. Answers will be discussed and posted under what we used to know or think. (10 minutes)

C. **Presentation:** A presentation about a study on the differences among Lebanese students who learned science in native language versus students who learned science in foreign language. The presentation will address the study that was administered on grade 2 students and at a middle class school who learned science in their first language (Arabic) and students who learned science in the second language (English). (20 minutes)

D. **Discussion and Questions:** 10 minutes

E. **Activity:** Introduction to different bilingual strategies with examples that can be used in science classroom to enhance better understanding of concepts. In small groups, participants will be given science concepts and will be asked to write a bilingual lesson. (20 minutes)

**Bilingual strategies to be discussed:**

- The one person, one language
- Preview - review
- Separation by topic and theme

F. **Conclusion & Reflection** Create their own graphic organizer to show the relationship between language and science and include recommendation for their own classrooms for more effective ways to teach science taking into consideration language. (10 minutes)

G. Participants will present their work. (10 minutes)

**Lesson Plat Du Jour: Starter and Plenary Recipes**

*Maryam Saad & Suzy Feghaly, Eastwood College, Kafarshima, Lebanon*

The primary purpose of this session is to increase participants' understanding of how to use lesson starters and plenaries to develop elementary students' understanding of various basic mathematical and scientific concepts. Participants will take on the role of the learner during the session by actually applying several types of starters and plenaries. Hands-on starters and plenaries deepen students' understanding, help make their thinking visible, and help equip them with sharper reflection tools. The session is planned as follows: (a) Brief introduction and initial exploration of a recommended lesson structure; (b) Participants will be equipped with tens of starters and they will apply some immediately. The activities will be followed by tens of plenary ideas; again the participants will have the opportunity to take part in a variety of plenary activities. The tasks will help ensure the first five minutes of any lesson are a time for motivation, energy and forward thinking and will help students to reflect on, and embed their learning at the end; (c) Participants will try to plan their own starter and plenary to a number of pre-assigned concepts; and (d) Participants will present their self-constructed starters and plenaries and reflect on their application in the session. Pitfalls associated with plenaries, and possible solutions will be discussed and participants will have the opportunity to ask questions and voice concerns.

## References:

*Shari Tishman, Patricia Palmer (2005).* ***Visible Thinking*** *- Available online at: http://www.pz.harvard.edu/resources/visible-thinking-article#sthash.ZNomqDnr.dpuf*

*S Jones, H Tanner, and M Treadaway, (2000). Raising standards in mathematics through effective classroom practice, Teaching Mathematics Applications19 (3): 125-134.*

*Helen Ward (2012). Is it time to ditch the rule of three? News | Published in TESS on 11 May, 2012 | By: https://www.tes.com/article.aspx?storycode=6225773*

*Karen Stephens (2014). Lesson Starters: An outdated idea or a meaningful teaching tool? The Bridge: Journal of Educational Research-Informed Practice Volume 1, Issue 1*

*Robinson, J. (2009). The importance of RE lesson starters. Available online at: http://news.reonline.org.uk/article.php?30*

*Gererd Dixie (2012)Introducing pace and purpose into your lessons. TES, available online at: http://newteachers.tes.co.uk/news/introducing-pace-and-purpose-your-lessons/45867*

*KERRIDGE, SUSAN (2012) A Study into the Improvement in the Mathematical Academic Attainment of Low Attainers in Year 7 (11 _ 12 year olds) when Accelerated Learning is used as a Teaching Pedagogy in the Classroom, Durham theses, Durham University. Available at Durham E-Theses Online:http://etheses.dur.ac.uk/3500/*

## Using Simulation as a Tool to Enhance Science Teaching

*Amal Zaatari, Hariri High School II, Beirut, Lebanon*

We are living in an era where rapid technological developments occur. Computer programs are becoming central to educational methods that facilitate students' learning. One of these programs are simulation labs, which are computer interactive program that imitate real situation. Students using simulation labs will explore certain concepts that are too difficult, dangerous, abstract, expensive, and time or material consuming, to perform in the real lab. Acquiring knowledge will be accomplished through fun by manipulating activity conditions and observing the result.

Session will be divided into three parts. The first part will be an introduction of simulation lab and its importance in enhancing teaching science especially abstract concepts, by allowing students to perform activities using simulation. Second part, the audience will perform science activities using simulation lab. Third part will discuss the effect of simulation activities on enhancing learning process along with its pros and cons.

### Description of session:

A - Welcome participants and introduce myself (5 mins)

B – Introducing the purpose of this workshop (15 mins)

C – Dividing participants into four groups.

D – Each group will perform an activity (15 mins)

E – Discussion of the impact of simulation activities on student's learning. (10 mins)

**Conclusion**

Discuss cons and pros of using simulation to enhance teaching science. (20 mins)

**Key Thinking Strategies to Ensure Students Success in Problem Solving**

*Laurie Anderson, International Consultant, Houghton Mifflin Harcourt International Publishers, Boston, MA. U.S.A.*

Giving students different thinking strategies to unlock problems opens up a whole new world of mathematics for students. We as teachers want to make it easy for our students to understand problem solving. In this session, we will be doing hands on activities which will be easy for the teacher to incorporate into their mathematic class. When the classroom promotes inviting ways to learn math it make it easier to learn. This session will be very interactive with whole group and small group activities.

Teachers are the key agents to change how we promote positive attitudes toward problem solving. We will look at the Professional Standards to make teaching mathematics easier. To fully incorporate the five process standards in the classroom, teachers must create an interactive classroom in which students work as a community of learners on mathematics. Hence, five professional standards. Teachers must have a classroom that promotes a mathematical community verse a collection of individuals. A classroom that promotes logic and mathematical evidence for verification verse teacher as sole authority for correct answers. A classroom that promotes math reasoning verse memorizing procedures. A classroom that promotes conjecture, inventing and problem solving verse routine finding of answers. A classroom that promotes connecting mathematics, its ideas and application verse treating mathematics as a body of isolated concepts and procedures How many of the Best Practice of Teaching Mathematics are we doing in the classroom? A look at what we are doing and how we can make a stronger connection with the students by using Best Practices in Mathematics but also Best Practices in teaching Problem Solving. From those standards we will also do activities that teachers can use in their classroom

How do I teach the children to unlock a problem? Modeling the Problem Solving Strategies and have teachers do problems with the different strategies. Small group work using math boards and manipulatives.

What should the children be thinking and recording? Teachers will look at the different thinking strategies that they can implement with the problems and instruction. Help the teachers understand that writing is also very important as the student problem solve and record answers in a written for to share with other students. Teachers will be given examples and then come up with their own ideas of how to effectively use a Math Journal.

Math Conversation is very effective strategy to extend the students understanding of problem solving. Teachers will be doing this as they are doing their activities.

Learning Styles and how to use this for differentiation. Teachers need to be aware of all learning style. We will do a short Learning Style quiz to see where the teachers are in their learning style. This will reflect on their teaching styles and how can we change how we teach to be more effective.

Teachers need to be sure to teach the language of Math. Math vocabulary is very difficult and is one of the biggest reasons that students struggle with Problem Solving. We will work through several strategies, from graphic organizers, concept word maps, and word squares.

How to integrate Mathematics in all of our teaching. We will look at some of the current strategies that are being used in classrooms around the world.

This session will be interactive and focus on getting our students to be thinkers and learners of mathematics, not only memorizers.

**The Colorful Sci-Ma Jumble**

*Louma Halawi, Mada Antar, & Roweida Bawab, Houssam Eddine Hariri High School, Saida, Lebanon*

Wait. What class is this? Do we have physics today? Students these days seem to have little rooms in their heads for the different subjects, and this might lead to them putting their other subjects aside when they enter another one of the little rooms in their heads, and we definitely don't want that! Students are failing to recognize the interdisciplinary links that are essential for development and advancement of societies and they are not transferring their mathematical thinking to the science class. However, the 21$^{st}$ century workplace demands a workforce equipped with a diverse range of interdisciplinary skills and knowledge that empower this workforce to examine problems through multiple perspectives and to resolve these problems by utilizing a wide set of skills that are not exclusive to one subject. The responsibility there lies in the hands of educators who must graduate problem-solvers who have a holistic view of things and who can recognize the undeniable connections between sciences and mathematics. The aim of this workshop is to illustrate how these disciplines can be connected in the classroom through designing tasks that emphasize the interdependence of science and mathematics and the utility of each discipline in the other. We want our students to blend the colors of our subjects to bring new colors to the world.

a) **Ice breaker:** ask attendees to choose four partners for the different times 12, 3, 6 and 9 according to different criteria.
b) **Introduction:**
    - Ask participants to come up with a definition of math, physics, chemistry and biology. Link them to each other in one definition.

- Present a diagram that shows the links between the different disciplines. (Fill in the links in these diagrams with the attendees)
- Pose the question: from your experiences, how many difficulties do you face when your science class needs math– use colored sticky notes to fill in a bar graph that shows how many are facing difficulties (we add a sticky note for each teacher in the place they see appropriate)
- Show small presentation of a study that shows the importance of interdisciplinary instruction (talk about famous people who were not closed in one discipline.)

**c) Activities:**

- Participants will view an introductory video that highlights the major objectives of the workshop.
- **The Distance Problem:** The groups will perform a task designed to be given to students that illustrates the connection between finding the distance from a changing velocity and the area of the region below the graph of the velocity function. By the end, every group is asked to share their answers as well as the connections they identified between the Physics and the Math of the problem and to identify the relevant math and physics topics that were integrated in the problem.
- **The Velocity Problem:** The groups will perform a task designed to be given to students that illustrates the connection between the derivative of a function and finding the instantaneous velocity. By the end, every group is asked to share their answers as well as the connections they identified between the Physics and the Math of the problem and to identify the relevant math and physics topics that were integrated in the problem.
- **Air Travel**: In this activity, the groups will be working in the aviation industry. They will need to use mathematical calculations in applying physics laws of motion. Furthermore, chemistry is integrated when speaking of fuel composition.
- **Carbon Dating:** is best explained when you want your students to review isotopes in chemistry and nuclear physics and half-life but also go through graph analysis all at once. This activity explains all concepts together but still keeps the fun and food.
- **Action Potential:** This is an interactive-driven interactive activity that explains the concept of resting potential that varies with the ionic concentrations in the phospholipid bilayer and measured by its potential difference.

d) Closure: (Group activity) Go back to the maps that we started with and come up with a task that combines at least two disciplines and in one minute, present it to the rest of the groups.