Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

PROFESSIONAL DEVELOPMENT MANUAL FOR PHYSICAL SCIENCE

JUNIOR SECONDARY PHASE

GRADES 8-9

2016

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Physical Science Training Manual Grades 8-9

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Activity 1: Introduction of facilitators

- We are going to do this small activity in pairs.
- We are required to chat to one another in pairs (preferably someone whom you have not chatted to before).
- Ask each other information such as:

    1. **your name and surname;**
    2. **school/institution where you work,**
    3. **region/directorate;**
    4. **your favourite topic in Physical Science (top of the list),**
    5. **your least favourite topic in Physical Science (bottom on the list),**
    6. **Anything fun you would like your partner to know about you such as the nickname your learners have given you, etc.**

- After we have exchanged each other's' information we are required to introduce one another. Each one of us will introduce our partner.

Activity 2: Workshop expectations

- Group activity (+/-10 minutes)
- In groups, please discuss your expectations from this workshop and write down your ideas on the flip chart provided.
- Choose a representative to present on behalf of the group to the entire house, (+/-5 minutes)
- Wrapping up (facilitators)

1.1 What is a workshop?

Workshops are occasions when people with a problem in common come together to pool experience and find answers. The emphasis is on 'work'. A 'shop' is a place for exchanging items for something of similar worth. So a workshop depends on the exchange of ideas between all participants who, collectively, may have far more experience in the subject than the facilitator.

To enable participants to work seriously they may need to be away from their normal setting. Successful workshops have an end product that has been shaped by the participants during their time together. In these ways workshops differ from seminars or conferences. In a seminar or conference there are teachers and an audience; a few people do most of the talking. The others mostly listen and learn.

1.2 Workshop objectives

The following are the objectives that the facilitators should aims to achieve during the training:

By the end of the training the teachers should be able to:

- Know and understand the aims and rationale for the Junior Secondary revised curriculum
- Use all curriculum documents appropriately and with confidence as a TOT and teacher
- Understand changes to the revised curriculum (learning content and assessment)
- Understand that teaching at Junior Secondary Level is primarily about conceptual understanding, development of skills and attitudes
- Realise that the inclusion of cross-curricular issues require proper planning (where appropriate)
- Realise and appreciate the significance of investigation in total development of learners

1.3 Obligations of Physical Science Facilitators'

As a Regional trainer for Physical Science, your role is crucial for the successful implementation of the revised syllabus. Therefore, it is important that you fully understand the content of the training and how to schedule your training in the region.

Your first obligation is to fully understand the following ideas:

- The scope and sequence of the revised Junior Secondary Physical Science syllabus
- The content of the revised syllabus- Physical Science
- Important changes in the curriculum compared to the previous one
- The urgency of developing key skills with each learner
- How to construct teaching and learning in an inquiry way
- How to prepare learners to develop basic inquiry skills (Scientific Method)
- The importance of learning support in science teaching and ways of applying it

As a selected trainer you should:

- **Be willing to learn** how to present all the above issues to the teachers you are going to train
- **Be willing to make sacrifices** and put real efforts into the training to make it a success through professional commitment
- **Reach out to** and show patience with all trainees, no matter how demanding they may be
- **Act professionally** all the time and focus on the task at hand as you are guided to do a
- **"Deliver the goods"**

1.4 What is the real responsibility of the trainer?

Remember, once the training starts, you will be on your own. The trainees will expect from you to guide them to improve their skills and become better Physical Science teachers. This could be a daunting task if you are not fully prepared for the challenge. You will direct the training and you should think of yourself as the facilitator all the time.

The training manual will not guarantee a successful outcome by just handing it out to the trainees and expect them to understand it, but it is there to ensure consistency across phases on the training content. You are in charge of your training sessions and should arrange a conducive environment where it will be easy to transfer the content in a convincing manner. As you know well, trainees will only learn and accept the content if they are participating and do things and become owners of the skills and information they need to have.

You may have to adapt to local circumstances or to the level or pace of the group(s) you are working with. Your commitments, perseverance and creativity could be challenged. You will **set the standards** for your groups and success will depend on your leadership throughout the days of training.

What else to know or do?

As a trainer, you are not responsible for everything. The Regional Office will arrange logistical arrangements for accommodation, meals and transport. However, you will need to ensure that everything is done and in place for the training. You will need to take care of the specific refinements and the layout of the training rooms and furniture to meet your needs and training style. You will consider ways to present some of the topics in an interesting way. You already know what parts of the training programme may be difficult to present or difficult for trainees to grasp. If you are mentally prepared for these, you will handle the training with greater confidence and care.

1.5 Goals

- Deliver training to all Grades 8-9 Physical Science teachers in Namibia
- Introduce the revised curriculum materials to the teachers
- Help teachers to understand how to apply the revised curriculum in their teaching

Hands-on, minds-on and words-on activity 1

Name: ……

Hands-on, minds-on and words-on ac

Activity 1
1.1 Making a mini-ecosystem!

In this activity, you are going to be introduced to how to make a "mini-ecosystem" which may find necessary to do either with your learners or teachers you are working with (if you are a subject advisor or curriculum officer or are working at a science centre or museum and so forth) or working with a Life Science or Biology teacher at your school.

What you need:

1. transparent bottle (made of glass or plastic) with a lid,
2. a young ever green plant (you could alternatively use indigenous seeds such as *Omahangu* (finger millet), Sorghum, Maize, beans, melons if an evergreen plant is not available)
3. some moist (not too wet) soil (preferably from where you took the plant from or the type of soil in which the type of seeds would usually grow best).

Procedure

- You are required to put the moist soil and the plant (or seeds) inside the bottle (remember the soil should not be too wet)
- You are then required to ask the learners/teachers to make some predictions (in groups and write them down) on what will happen to the plant when the bottle is closed with the lid and put on the window seal and give explanations to their predictions. If it is possible it would be nice if each group could make their own mini-eco-systems;
- Learners/teachers are then required to observe the mini-ecosystem or their group mini-ecosystems and write down their observations and explanations thereof;
- Learners/teachers are also required to write down all science topics and related scientific concepts coming from the mini-ecosystem;
- Learners/teachers will be required to use the science concepts to do mind-maps and thereafter concepts maps; and
- Learners/teachers are required to write down some reflections on their experiences of doing a mini-ecosystem.

This activity is an environmental activity and can be done across the curriculum in most science subjects such as Natural Science and Health Education, Physical Science, Life Science, Biology, Agricultural Science and Geography. It links well with Education for Sustainability Development (ESD) and is applicable to all grades 0-12.

You will be given samples of mini ecosystem projects to relate to!

1.2 Preparation of the traditionally brewed non-alcoholic *Oshiwambo* beverage called *Ontaku/Oshikundu*

Ingredients and apparatus/equipment needed:

- *Omahangu* flour
- Flour from *Omahangu*/Sorghum germinated seeds
- Residue from already fermented *ontaku/oshikundu* called *oshipithitho*
- Hot water (just below boiling point)
- Cold water (at room temperature)
- Bucket
- Plastic bottles x 4
- Balloons x 4

Procedure

1. Take a generous amount (such as 1 kilogram) of *Omahangu* flour and put it in a bucket
2. Boil about 2 litres of water in a kettle and allow it to cool down slightly so that it is just hot enough
3. Pour the hot water in the *Omahangu* flour in the bucket and stir continuously to form a evenly mixed paste
4. Pour about two hands full of the germinated *Omahangu* or germinated sorghum flour
5. Stir continuously until the paste is evenly mixed
6. Continue to stir continuously until the paste reaches room temperature
7. Add cold water (at room temperature) to dilute the paste until it forms a dilute mixture of preferred thickness
8. Pour approximately equal volumes of the dilute mixture into four containers of approximately equal volumes
9. Prepare four different samples (A, B, C, D) of the *Ontaku/Oshikundu* as follow:
   A. *Ontaku/Oshikundu* with *Oshipithitho* and leave it at room temperature (control)
   B. *Ontaku/Oshikundu* without *Oshipititho* and leave it at room temperature
   C. *Ontaku/Oshikundu* with *Oshipithitho* and put it in a refrigerator (or allow it to overnight in a cold place outside the room)
   D. *Ontaku* without *Oshipithitho* and put it in a refrigerator (or allow it to overnight in a cold place outside the room)
10. Once all the four samples of *Ontaku/Oshikundu* have been prepared, put a deflated balloon on the mouth of each bottle A, B, C, D and leave it over night (or approximately 5 hours) for further observations the following day. Take pictures of the samples.

Predictions and explanations for predictions

- First *individually*, then *in groups*, predict what you would observe in each of the samples of *Ontaku/Oshikundu* **A,B, C and D** after +/- 5 hours
- Write down explanations for your predictions. What do you think would happen in each sample and why?

	PREDICTIONS	**EXPLANATIONS FOR THE PREDICTIONS**
A	…… …… …… …… …… …… …… ……	…… …… …… …… …… …… …… ……
B	…… …… …… …… …… …… …… ……	…… …… …… …… …… …… …… ……
C	…… …… …… …… …… …… …… ……	…… …… …… …… …… …… …… ……
D	…… …… …… …… …… …… …… ……	…… …… …… …… …… …… …… ……

1.3 Preparation of yeast and sugar solution

Ingredients and apparatus/equipment needed:

- A plastic bottle (preferably 2 litre)
- Like-warm water
- Yeast sachet
- White sugar
- Brown sugar

Procedure

1. Pour lukewarm water in a container such as a bucket.
2. Add a generous amount of sugar to the lukewarm water (about half a cup)
3. Add one sachet of yeast to the solution
4. Stir continuously until the mixture is evenly mixed
5. Pour the mixture into a 2 little plastic bottle
6. Put a deflated balloon at the mouth of the plastic bottle
7. Observe for about 5 hours

1.4 Eggs in different liquids

What we need:

- About 3 eggs per group
- Vinegar
- Lemon juice
- Tap water
- 3xbeakers

Procedure

1. Take 3 beakers. Pour vinegar in one of the beakers and label in (**V**). Pour lemon juice in another beaker and label in (**L**). Pour tap water in the third beaker and label in (**W**).
2. Immerse an egg in each of the liquids respectively (**V, L and W).**
3. What do you think will happen to the egg in each of the beakers **V, L and W** after 2 to 3 days?
4. Write down your predictions and explanations for your predictions in the table below**.** What do you think would happen to the egg in each case?

	PREDICTIONS	EXPLANATIONS FOR YOUR PREDICTIONS
V	…… …… …… …… …… …… …… ……	…… …… …… …… …… …… …… ……
L	…… …… …… …… …… …… …… ……	…… …… …… …… …… …… …… ……
W	…… …… …… …… …… …… …… ……	…… …… …… …… …… …… …… ……
C	…… …… …… …… …… …… …… ……	…… …… …… …… …… …… …… ……

2. Understanding adult-learning theory (Andragogy)

As a facilitator, you are going to work with fellow teachers who are adults. Therefore there is a need to have an understanding of how adults learn. The theory of adult learning is called 'Andragogy'.

Here are some characteristics of adult learners which may help in working with adults:

- Adults come to learning situations with a variety of motivations
- Adults come to learning situations with definite **expectations** about a particular learning goals and teaching methods
- Adults present with different learning styles
- Much of adult learning is re-learning rather that new learning
- Adult learning often involves changes in attitudes as well as skills
- Most adults prefer to learn through experience-combining practice with feedback
- Incentives for adults learning usually comes from within the individual
- It is important to respect the group's previous knowledge and experience, motivation to learn, potential resistance to change, and ability to function as co-learners

How can I use adult learning principles to facilitate student learning on placement?

Good question!! Here we will discuss some ways to facilitate learning by applying Knowles' Adult Learning Principles:

Adults are internally motivated and self-directed

Adult learners resist learning when they feel others are imposing information, ideas or actions on them (Fidishun, 2000).

Your role is to facilitate a students' movement toward more self-directed and responsible learning as well as to foster the student's internal motivation to learn.

As clinical educator you can :

- Set up a *graded learning program* that moves from more to less structure, from less to more responsibility and from more to less direct supervision, at an appropriate pace that is challenging yet not overloading for the student.

- *Develop rapport* with the student to optimise your approachability and encourage asking of questions and exploration of concepts.

- *Show interest* in the student's thoughts and opinions. Actively and carefully listen to any questions asked.

- *Lead the student toward inquiry* before supplying them with too many facts.

- Provide *regular constructive and specific feedback* (both positive and negative),

- *Review goals* and *acknowledge goal completion*

- *Encourage use of resources* such as library, journals, internet and other department resources.

- *Set projects or tasks* for the student that *reflects their interests* and which they must complete and "tick off" over the course of the placement. For example: to provide an in-service on topic of choice; to present a case-study based on one of their clients; to design a client educational handout; or to lead a client group activity session.

- *Acknowledge the preferred learning style* of the student. A questionnaire is provided below that will assist your student to identify their preferred learning style and to discuss this with you.

Adults bring life experiences and knowledge to learning experiences

- Adults like to be given opportunity to use their existing foundation of knowledge and experience gained from life experience, and applies it to their new learning experiences. As a clinical educator you can:

- *Find out about your student* - their interests and past experiences (personal, work and study related)

- *Assist them to draw on those experiences* when problem-solving, reflecting and applying clinical reasoning processes.

- *Facilitate reflective learning opportunities* which Fidishun (2000) suggests can also assist the student to examine existing biases or habits based on life experiences and "move them toward a new understanding of information presented" (p4).

Adults are goal oriented

Adult students become ready to learn when "they experience a need to learn it in order to cope more satisfyingly with real-life tasks or problems" (Knowles,1980 p 44, as cited in Fidishun, 2000). Your role is to facilitate a student's readiness for problem-based learning and increase the student's awareness of the need for the knowledge or skill presented. As educator, you can:

- *Provide meaningful learning experiences* that are *clearly linked* to personal, client and fieldwork goals as well as assessment and future life goals.

- *Provide real case-studies* (through client contact and reporting) as a basis from which to learn about the theory, OT methods, functional issues implications of relevance.

- *Ask questions* that motivate reflection, inquiry and further research.

Adults are relevancy oriented

Adult learners want to know the relevance of what they are learning to what they want to achieve. One way to help students to see the value of their observations and practical experiences throughout their placement, is to:

- *Ask the student to do some reflection* on for example, what they expect to learn prior to the experience, on what they learnt after the experience, and how they might apply what they learnt in the future, or how it will help them to meet their learning goals.

- *Provide some choice* of fieldwork project by providing two or more options, so that learning is more likely to reflect the student's interests.

"*Students really benefit from regular 'teaching sessions' - time spent going through assessments such as how to do a kitchen assessment, and having in-services presented on specific topics - such as Cognition or Perception*" " *I find they understand more about a topic when it is directly relevant to the work context. This is invaluable as it ties theory to practice.*" S. Bartholomai, OT clinical educator, Ipswich Hospital (personal communication, May 31, 2007)

Adults are practical

Through practical fieldwork experiences, interacting with real clients and their real life situations, students move from classroom and textbook mode to hands-on problem solving where they can recognise firsthand how what they are learning applies to life and the work context. As a clinical educator you can:

- *Clearly explain your clinical reasoning* when making choices about assessments, interventions and when prioritising client's clinical needs.

- *Be explicit* about how what the student is learning is useful and applicable to the job and client group you are working with.

- *Promote active participation* by allowing students to try things rather than observe. Provide plenty of practice opportunity in assessment, interviewing, and intervention processes with ample repetition in order to promote development of skill, confidence and competence.

"*I like to encourage students to select and use a clinical model, such as Chapparo and Rankin's OPM, to apply to practice. It helps students to identify what performance components (e.g. endurance, tone, organisational skills) they want to assess for example, in a dressing task. This helps to reinforce why OTs do things, and how the link to occupation differs from other disciplines.*" (S. Bartholomai, personal communication, May 31, 2007)

Adult learners like to be respected

Respect can be demonstrated to your student by:

- *Taking interest*
- *Acknowledging the wealth of experiences* that the student brings to the placement;
- *Regarding them as a colleague* who is equal in life experience
- *Encouraging expression* of ideas, reasoning and feedback at every opportunity.

It is important to keep in mind that the student is still developing occupational therapy clinical practice skills. However, with the theory and principles of adult learning in mind, you can facilitate the learning approach of the student to move from novice to more sophisticated learning methods. This facilitates greater integration of knowledge, information and experience; the student learns to distinguish what is important when assessing and working with clients; how to prioritise client needs, goals and caseload; when rules can be put aside and how/when the approach to occupational therapy practice and professional communication emerges from strict modelling of behaviour into a unique therapeutic and professional expression of self. (Fidishun, 2000; Lieb,1991)

3. Background information

The new curriculum for Physical Science for the junior secondary phase will be implemented in grade 8 in 2017 and in grade 9 in 2018. The training is done at once although the implementation is by way of grade implementation. At NSSCO and NSSCH, the subject will change from Physical Science to Physics and Chemistry. At grade 10 to 11, Physics and Chemistry NSSCO will be offered. At grade 12 level, Physics and Chemistry NSSCH will be offered. For the successful implementation of the new curriculum, there is a need to lay a strong foundation at JS level so that learners are well prepared for the NSSCO and eventually NSSCH levels.

In grade 9, learners will write a semi-external examination. This means that the examination will be set by DNEA and it will be marked at the regions/schools.

Activity 3

- Identity and analyse the three main parts/sections of the syllabus.
- Feedback

Activity 4

- Analyse part 1 and 3 of the syllabus by comparing the old syllabus and the new syllabus.
- Identify what is new, what are the changes
- Feedback

Hands-on, minds-on and words-on activity 2

Name:…….

1. **Having fun with gases**

We are going to prepare some gases as follows:

1. From the *Ontaku/Oshikundu* practical activity (activity 1
2. From the water, yeast and sugar mixture (activity 1)
3. From reacting vinegar and bicarbonate of soda
4. From exhaled air
5. From a coca-cola soft drink

Pass each the gases in each of the instances above through clear limewater.
Write down your predictions and explanations for your predictions in each of these instances.

sample	Predictions	Explanations for your predictions
1	…… …… …… ……	…… …… …… ……
2	…… …… …… ……	…… …… …… ……
3	…… …… …… ……	…… …… …… ……
4	…… …… …… ……	…… …… …… ……
5	…… …… …… ……	…… …… …… ……

After passing each of the gases in 1, 2, 3, 4 and 5, write down your observations and explanations for observations

sample	Observations	Explanations for your observations
1	…… …… …… ……	…… …… …… ……
2	…… …… …… ……	…… …… …… ……
3	…… …… …… ……	…… …… …… ……
4	…… …… …… ……	…… …… …… ……
5	…… …… …… ……	…… …… …… ……

2. Investigating the pH nature of exhaled air

What we need:

- Tap water
- Test tubes
- Universal indicator solution
- Drinking straws

Procedure

1. Pour water in a test tube and predict what the colour change would be if universal indicator drops are added to the water. Write down explanations for your predictions.
2. Add 2-4 drops of universal indicator solution to the water in the test tube. Make observations and write down explanations to your observations

Predictions	**Explanation for your prediction**
…… …… …… ……	…… …… …… ……
Observations	**Explanation for your observation**
…… …… …… …… …… …… ……	…… …… …… …… …… …… ……

3. Predict what would happen if you take a drinking straw and blow exhaled air through the mixture of tap water and universal indicator solution. Write explanations for your predictions.
4. Take a drinking straw and blow exhaled air through the universal indicator and water solution prepared in number 1 above.

Predictions	**Explanation for your prediction**
…… …… …… ……	…… …… …… ……
Observations	**Explanation for your observation**
…… …… ……	…… …… ……

3 Investigating carbon dioxide and combustion

We are going to prepare a carbon dioxide atmosphere in a container using vinegar and baking soda.
We are going to bring a burning splint in contact with the carbon dioxide atmosphere.
We are also going to bring a burning magnesium ribbon in contact with the carbon dioxide atmosphere.

A burning splint in contact with CO_2 atmosphere	**A burning magnesium ribbon in contact with CO_2 atmosphere**
PREDICTIONS …… …… …… …… …… …… ……	**PREDICTIONS** …… …… …… …… …… …… ……
EXPLANATIONS FOR PREDICTIONS …… …… …… …… …… …… ……	**EXPLANATIONS FOR PREDICTIONS** …… …… …… …… …… …… ……
OBSERVATIONS …… …… …… …… …… …… ……	**OBSERVATIONS** …… …… …… …… …… …… ……
EXPLANATIONS FOR OBSERVATIONS …… …… …… …… …… …… ……	**EXPLANATIONS FOR OBSERVATIONS** …… …… …… …… …… …… ……

4 Investigating the gas produced when Aluminium foil reacts with caustic soda

What we need:

1. Helium gas (if obtainable from a local shop which pumps helium balloons), in Windhoek for instance there is a shop that pumps for N$10 per balloon
2. Caustic soda (sodium hydroxide)
3. Aluminum foil
4. Vinegar
5. Bicarbonate of soda
6. Balloons
7. Plastic bottles

Procedure

1. Label the helium balloon (if available) as **A.** Helium balloons lasts for about 8 hours.
2. Pour water in a plastic bottle and add a generous amount of caustic soda to the water. Feel the bottle with your skin (arm).
3. Put pieces of aluminium foil in the solution formed in 1 and put a balloon at the mouth of the plastic bottle. Label this balloon **(C)**
4. Prepare another balloon of gas using vinegar and bicarbonate of soda. Label this balloon **(B).**
5. Freely suspend the three balloons (**A, B and C**) in air and compare their properties????

   How do the three balloons compare? Explain your observation.

……
……
……..

6. Introduce a burning splint\candle to each of these balloons. Write down observations and explanations for the observations

	Observations	**Explanation for the observations**
A		
B		
C		

5 Investigating the gas produced when potassium permanganate is heated

What we need:

1. Potassium permanganate crystals
2. Test tubes x 2
3. Stopper
4. Delivery tube
5. Methylated spirits burner
6. Wooden splint

Procedure

1. Put a 1 spatula of potassium permanganate in a test tube.
2. Close the test tube with a stopper fitted with a delivery tube
3. Heat the potassium permanganate gently over a methylated spirits flame
4. Collect the gas in the second delivery tube
5. Ignite a wooden splint with a flame an extinguish the flame so that it is just glowing
6. Insert the glowing splint in the test tube that you have collected

Make predictions, Observations and Explanations

……
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……
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……

Activity 5

Analyse the grade 8 learning content and identify challenging topics

- Compare the old and new syllabuses for JS Physical Science and identify changes in the syllabus
- Identify challenging topics in the new JS Physical Science syllabus grades 8 and 9 and arrange them in order from most challenging to least challenging
- Feedback and discussion!

In groups, we are going to develop sample activities/worksheets on the most challenging topics that we have identified and we are going to present our ideas to the entire house.

Activity 6

Analyse the grade 9 learning content and identify challenging topics

- Compare the old and new syllabuses for JS Physical Science and identify changes in the syllabus
- Identify challenging topics in the new JS Physical Science syllabus grades 8 and 9 and arrange them in order from most challenging to least challenging
- Feedback and discussion!

In groups, we are going to develop sample activities/worksheets on the most challenging topics that we have identified and we are going to present our ideas to the entire house.

Hands-on, minds-on and words-on activity 3

Name: ……

1. **Having fun with tea bags!**

What you need:

- Tea bags (e.g. five roses)
- Hot water (approximately at boiling point)
- Cold water (preferably from the refrigerator)

Procedure

1. You need to put cold and hot water of approximately equal volume [e.g. 150 ml] respectively in two different containers such as beakers
2. You need to put a tea bag in each of the containers
3. Write down predictions and explanations for the formation of colour by the tea bag in the water.
4. Also write down observations and explanations for the observations

Tea bag in cold water	**Tea bag in hot water**
Predictions	**Predictions**
Explanations for predictions	**Explanations for predictions**
Observations	**Observations**
Explanations for observations	**Explanations for observations**

2. Having fun with cool drink cans!

What you need:

- Cool drink cans (preferably 440 ml)
- A source of heat (preferably a methylated spirits burner)
- A cold water bath

What to do?

1. Place a small amount of water in the can (approximately 20ml) and heat it over the heat source until it starts to boil.
2. After one to two minutes of boiling and observation of steam coming out of the can, remove the can from the heat source as quick as humanly possible, (take extra care not to burn) and immerse it in water (upside down) as fast as you can.
3. Write down your observations and explanations for your observations on what happened to the can and explain why?

OBSERVATIONS	**EXPLANATIONS FOR OBSERVATIONS**

3. Having fun with eggs!!!

What to do?

1. Make observations on the eggs prepared **in activity 1 on placing eggs in different liquids (vinegar, lemon juice, tap water)**.
2. Put an egg in a beaker with hydrochloric acid.

   Make observations and explanations for your observations

……
……
……

3. How does the effect of vinegar and hydrochloric acid on eggs compare.

……
……
……

4. Having fun with white sugar!

What we need:

1. White sugar, 500g
2. Concentrated sulfuric acid (98%) (**remember sulfuric acid is found in car batteries**)
3. A glass beaker (**the beaker should be considered a loss, it cannot be used again after this**)
4. Water
5. Safety goggles
6. A dropper pipette
7. Gloves
8. A lab coat if possible

Procedure

1. Put a generous amount (approximately half-full) of white sugar in a glass beaker
2. Carefully add small amounts using a dropper pippette
3. Protect your eyes with safely goggles as sulfuric acid is extremely corrosive and hazardous

MAKE OBSERVATIONS AND EXPLANATIONS FOR OBSERVATIONS

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4 Pedagogical Content Knowledge (Shulman 1986, 1987)

> According to Shulman (1986), pedagogical content knowledge
> .."embodies the aspects of content most germane to its teachability. Within the category of pedagogical content knowledge I include, for the most regularly taught topics in one's subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations - in a word, the ways of representing and formulating the subject that make it comprehensible to others..[It] also includes an understanding of what makes the learning of specific concepts easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning.(p. 9)

Shulman (1986, 1987) posit that there are 7 categories of knowledge that teachers ought to have.

Content Knowledge:

1. **Subject Matter Knowledge (SMK)**
2. **Pedagogical Content Knowledge (PCK)**
3. **Curriculum Knowledge**
   Pedagogy
4. **General pedagogy**
5. **Learners and their characteristics**
6. **Educational Contexts**
7. **Educational Purpose**

1 Subject Matter Knowledge (SMK)

- The amount of subject content knowledge in the mind of the teachers.
- This is the primary requirement for every subject teacher and pre-requisite for subject teaching
- E.g for admission at tertiary institution you should have scored a C symbol in the subject you intent to specialise in, etc.
- As teachers, we are encouraged to enhance our content knowledge every day! We all learn something new every day!

2 Pedagogical Content Knowledge (PCK)

- SMK is a pre-requisite for PCK
- PCK is what makes teachers <u>teachers</u>
- Integration/blending of methods + pedagogy
- Teacher understanding of what is to be learned and how it is to be learned e.g. difference between a strong and a weak acid. One could use eggs with water, lemon juice, vinegar, hydrochloric acid. Sugar and Sulfuric acid.
- Using the most useful forms of representation of those ideas, most powerful analogies, illustrative examples, explanations and demonstrations.
- Understanding of what makes the learning of specific topics easy/difficult. The conceptions/misconceptions

- The way the content is represented to make it interesting and comprehensible to the learners

3 Curriculum Knowledge

- Knowledge of the curriculum scope and sequence (e.g. bonding- grade 8 (covalent), grade 9 (covalent, ionic), grade 10 (covalent, ionic metallic), grade 11 (coordinated/dative bonding) etc.
- Knowledge of topics to be taught in preceding years and later years.
- Curriculum knowledge of similar topics in other subjects at the same grade e.g. Respiration/ photosysthesis (Physical Science, Life Science); Acids and soil pH (Physical Science/ Agricultural Science); dangers of isotopes in mutations (Physical Science/Life Science) etc.
- Curriculum knowledge of materials available for instructions eg. YouTube videos, Xtremepapers CIE, E-Campus Namibia, etc.

4 General pedagogy

- Those ideas, most powerful analogies, illustrative examples, explanations and demonstrations
- As referred to in PCK

5 Learners and their characteristics

- Know our learners: average, below average, above average e.g. when giving group projects.
- Know the level of motivation, attitude, prior-knowledge of our learners
- Understanding the social, political, cultural and physical environments in which students are asked to learn
- Ignite enthusiasm in our learners and empower them (**disposition**)
- Know characteristics such as multiculturalism

6 Educational Contexts

- Understand the context e.g. rural, urban, semi-urban, suburb, remote etc.

Using prior everyday knowledge in teaching and learning

A Nigerian case study, “The ability to effectively educate future scientists and citizens is predicated in part upon how students are able to relate what they learn in school to their daily lives and how teachers have been helping students establish such connections during science teaching and learning” (Oloruntegbe & Ikpe, 2011). “Are teachers consciously using phenomena from their students’ daily life as examples in presenting material on chemistry” ((Oloruntegbe & Ikpe, 2011). They related to household activities such as cooking, boiling water, melting, freezing, evaporation, drying, making solutions, laundry, ironing, gardening etc to scientific concepts such as melting point, boiling point, filtration, decantation, saturated vapour pressure, evaporation, rusting, corrosion, alloy, oxidation, reduction, condensation, phase changes/changes of state. Findings have showed inability to make links and bridges between school science and relevant phenomena in their homes despite daily exposure to both. Socio-economic status had little effect in making of links. If teachers could use home examples in lessons.

Implications:

- Science teachers, textbook authors, teacher trainers, curriculum planners
- A solid and deep understanding of science and in particular chemistry is important as a foundation for university studies
- Students may pass with A* in schools but may quit science courses at University
- A broad array of home activities may provide a source for meaningful, experiential based teaching and learning and in-depth understanding of science concepts
- Teachers ought to make links between learners' experiences at home and classroom science

Stears, Malcolm and Kowlas (2003)

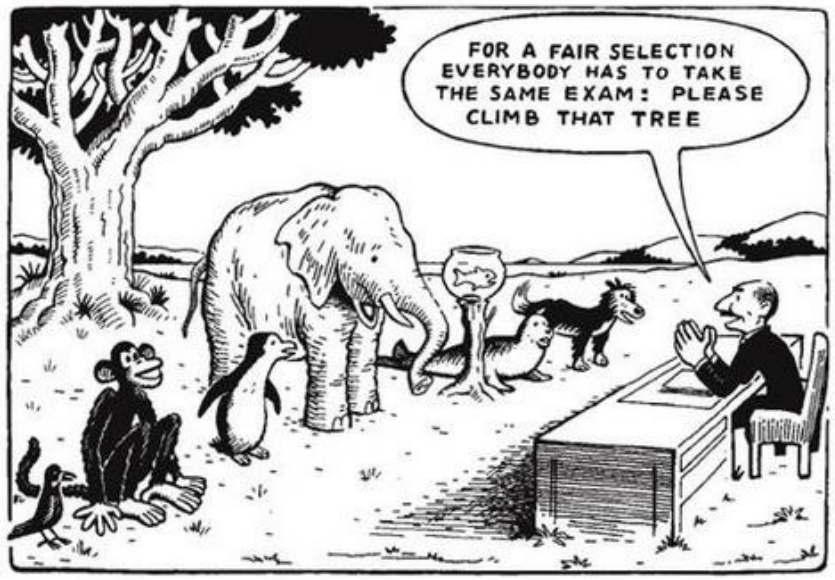
- the greater the connectedness of school science with children's interests and experiences, the greater the level of engagement of children with each other and the content.

Mukwambo, Ngcoza and Chikunda (2014) argue that since there is a dialectical relationship between our everyday practices science and the science learned in school, this can be used to reduce the challenges associated with the abstract nature of science.

Le Grange (2007) convinces that it is important for science to be viewed as a human and social activity which is situated (context embedded), as performance, as doing.

Learning *from context to content* (

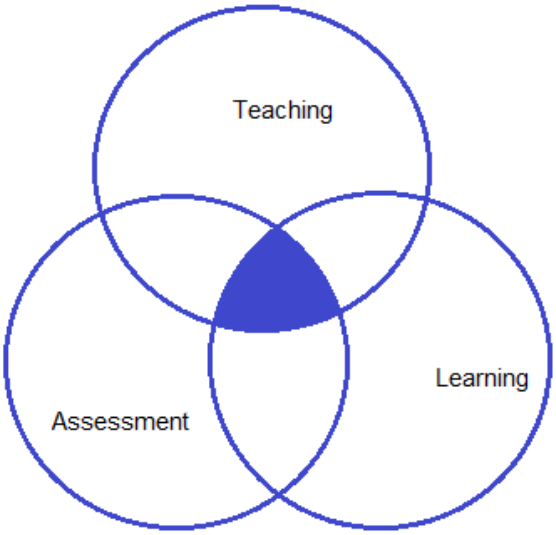
This type of learning is similar to what we tried to model during the "hands-on", words-on" "minds-on" activities we carried out. Providing the context first to the learners and then using the scientific concepts and content to explain the concepts. For example, when eggs are put in vinegar, the shell dissolves, that is the context given to learners. After that, the teacher discusses with learners why the egg shells dissolve in vinegar. This enables movement to content for example vinegar contains acetic acid and the egg shell is made up of mainly calcium carbonate. A chemical reaction takes place between an acid and a carbonate forming salt, water and carbon dioxide. This enables a learner to make further links when teaching reactions between acids and carbonates, etc.



7 Educational Purpose

- This is in line with the rationale of the curriculum of the country as stipulated in the syllabuses and curriculum documents.
- Vision 2030 " …a prosperous and industrialised Namibia developed by her human resources, enjoying peace and political stability..."

5. Assessment



“Teaching and Learning are not synonymous. You can teach and teach well, without having the students learn”, (Bodner, 1986, p. 873). In the traditional science teaching approaches, emphasis was placed mainly on the transmission and regurgitation of facts . Rather than focusing on scientific concepts, emphasis was placed on rote learning (Bodner, 1986). Also, being able to do practical activities in science does not necessarily imply comprehension (Wilson & Stensvold, 1991). Often, there is a tendency for science teachers to equate activity and learning (Maselwa & Ngcoza, 2003).

5.1 The PEEOE approach as a tool for assessment in science

This approach was adopted by Maselwa and Ngcoza (2003). They argue that learners need to be given a chance to make predictions and explain their predictions before the practical activity is carried out. For example the way we have done our “hands-on, words-on and minds-on” practical activities, we made predictions first before we carried out the practical activities. This gives learners a chance to think and talk which resonates well with “minds-on and words-on”. The practical activity of the eggs and vinegar for instance, the activity on tea bags in hot water and cold water, you could ask learners to predict what they think will happen in each case and explain why. After that, they will go on to experiment and that is where “Explore” comes in. During exploring, learners will go on and make observations and then give explanations for their observations.

5.2 Formative assessment, referred to as "Assessment for Learning" (AfL)

1. Sharing of learning intentions and success criteria
2. Effective feedback from the teacher
3. Strategic questioning
4. Peer feedback
5. Student reflection, self-monitoring and self-assessment
6. Making formative use of summative assessment

(Black, Harrison, Lee, Marshall & William)

Good classroom practices such as hands-on, minds-on and words-on practical activities can bring about:

- Improved student engagement and motivation
- Increase in student self-esteem
- An increased willingness on the part of students to reflect on their learning and to take responsibility for their own progress

And most importantly in improved student achievement. Students experience greater success with their learning

Hands-on, minds-on and words-on activity 4

Eva

WORKSHEET ON ELECTROSTATICS

ACTIVITY 1

PURPOSE: To investigate what happens when one insulator rubs another insulator and the objects are brought near each other.

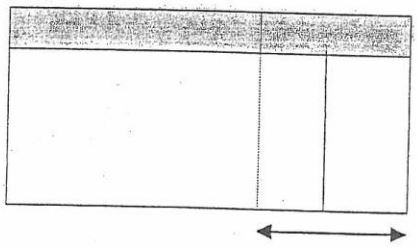
RESOURCES:

For this activity you will need

- A firm plastic (transparency).
- A hard plastic ruler.
- A pair of scissors.

WHAT TO DO:

Cut a 20 mm strip from the transparency from its breadth as shown below.



Now cut this strip in the middle (10mm) But DO NOT cut the shaded part.

1. PREDICT what will happen when you rub the strips with the inside of your jacket, your jersey, your tie, the outside of your jacket, or your hair etc.

   PREDICTION ----------

   EXPLAIN YOUR PREDICTION----------

1

Now rub the plastic strips using any of the above-mentioned objects. Rub about 3 times.

WHAT DO YOU OBSERVE? ----------

EXPLAIN YOUR OBSERVATION: ----------

PREDICT what will happen if you bring the plastic ruler or your finger close to the rubbed plastic strips

PREDICTION ----------

EXPLAIN YOUR PREDICTION----------

---

2. Now RUB the plastic ruler using any of the above-mentioned objects. RUB about 3 times. Bring the rubbed ruler close to ONE of the strips.

   WHAT DO YOU OBSERVE? ----------

   EXPLAIN YOUR OBSERVATION----------

   ---

3. Let us go back to the LIGHTNING STORM picture. What charges did we see in the picture?

   ---

4. Do you think that the SAME CHARGES are found in other matter? ----------

   EXPLAIN YOUR ANSWER----------

   ---

5. CHALLENGES:

   5.1 What charge do the plastic strips have after being rubbed using the different types above-mentioned objects? EXPLAIN----------

   ---

   5.2 What charge do the objects have after being used to rub the plastic strips?

   EXPLAIN ----------

5.3 EXPLAIN why a CHARGED object and a NEUTRAL object attract?

---

6. Let us look at the TRIBOELECTRIC SERIES below.
Scientists have ranked materials in the order of their ability to hold or give up electrons. This ranking is called the triboelectric series

Your hands
Glass
Your hair
Nylon
Wool
Fur
Silk
Paper
Cotton
Hard rubber
Polyester
Polyvinylchloride plastic

NOTE: The one higher up in the list should give up electrons and become positively charged.

CONSOLIDATION:

8. Can you write a SUMMARY of your INVESTIGATION? Begin this way:
When PLASTIC is rubbed with FINGERS or SILK, the plastic gets a
---------- charge
When PLASTIC is rubbed with a JERSEY or HAIR , the plastic gets a

---------- charge

Charges of the SAME KIND----------

Charges of DIFFERENT KINDS----------

A CHARGED object can ----------a NEUTRAL object.

9. From the SUMMARY of your INVESTIGATION we can NOTE that:

Note: There is a FORCE between CHARGES.

There is also a FORCE between CHARGES and NEUTRAL objects.

WORKSHEET ON THE FORCE BETWEEN CHARGES

ACTIVITY 2.

PURPOSE: 2 (a) To investigate the effect on the amount of FORCE when the amount of CHARGE is increased (what happens to the force when we increase the charges)?

2 (b) To investigate what a CHANGE in the DISTANCE between A CHARGED object does on the FORCE.

RESOURCES:

For this activity you will need

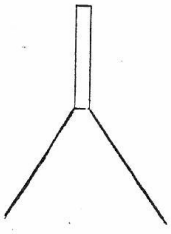
Two plastic strips.

A ruler.

WHAT TO DO:

Rub the two strips at the same time TWICE with silk or your fingers.

ESTIMATE the distance between the bottom edges of the strips



Estimated distance between strips----------

Repeat the rubbing of the strips THREE TIMES and then FOUR TIMES, record your estimations each time in the table below.

NUMBER OF RUBBINGS	AMOUNT OF CHARGE (small or big or bigger)	WHAT HAPPENS TO THE FORCE

When you increase the number of rubbings what are you doing to the amount of charge? -----

---

What can you say about the SIZE OF THE FORCE when the amount of CHARGE CHANGES?

EXPLAIN YOUR ANSWER CLEARLY----------

Now for the next investigation -RUB ONLY ONE strip THREE TIMES to give it a charge. RUB a plastic ruler to give it a charge. Slowly bring the ruler to the strip. Start from a distance of about 120mm from the strip and record your estimations each time.

Record your findings in the following table:

AMOUNT OF CHARGE	DISTANCE FROM STRIP	WHAT HAPPENS TO THE FORCE
	120 mm	

What can you deduce about the FORCE between CHARGES as the distance between the charges CHANGES?

EXPLAIN YOUR ANSWER CLEARLY----------

Now, use the information you gathered in Activities 2(a) and 2(b) and write in your OWN words your deductions.

Appendices

Registration form for Physical Science Professional Development workshop

No	Surname and name	Gender	School	Mobile number	email address	Signature
0	Asheela Eva	Female	J G Van Der Walt SS	0812964320	easheela@nied.edu.na asheelaeva@gmail.com	*E.N. Asheela*
1						
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No	Surname and name	Gender	School	Mobile number	email address	Signature
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37						

Physical Science Professional Development workshop: Attendance List

Region: …… **Date: …….**

Facilitator: ……. **Venue: ……..**

No.	Surname + Name	Day 1	Day 2	Day 3
		Signature	Signature	Signature
1				
2				
3				
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No.	Surname + Name	Day 1	Day 2	Day 3
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REPUBLIC OF NAMIBIA

MINISTRY OF EDUCATION, ARTS AND CULTURE

National Institute for Educational Development (NIED)

Workshop Evaluation Form

JS Physical Science syllabus workshop (31 May -2 June 2016)

Now that we have come to the end of the workshop, please be so kind to complete this evaluation form.

NOTE: Completing the evaluation objectively and honestly would contribute a great deal to improvement of similar workshops in future.
Please tick ✓ ( ) only Yes or No where necessary.

1. Summarise the evaluation of the entire training by completing the table underneath.

Session	Summary of evaluation per session
Registration, Welcoming, Introduction, House rules Objectives and expectations session	--- --- --- --- --- ---
hands-on, minds-on, words-on activity 1 (mini-ecosystem project; oshikundu/ontaku; yeast and sugar solution; eggs in different liquids)	--- --- --- --- --- ---

Background information and Orientation session	----------
Principles of adult learning (Andragogy)	----------
Activity 3 session: Three main sections of the syllabus	----------
Activity 4 Session: New aspects in the information and assessment sections of the syllabuses	----------

hands-on, minds-on, words-on activity 2 (The chemistry of gases: oxygen, hydrogen, carbon dioxide)	----------
Activity 5 session: (Analyse the grade 8 learning content, identify challenging topics and develop sample activities)	----------
Activity 6 session: (Analyse the grade 9 learning content, identify challenging topics and develop sample activities)	----------
hands-on, minds-on, words-on activity 3 **(having fun with: tea bags, cool drink cans, eggs, white sugar)**	----------

Integrating ICT (YouTube videos)	----------
Activity 7: Topic tasks, practical investigations, projects , continuous assessment, assessment for learning	----------
Pedagogical Content Knowledge (PCK)	----------

2. Which session(s) did you find most useful during the training course?

……

……

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……

3. Which activities do you think were less useful and why?

……

……

……

…….

4. Were you satisfied with the materials and facilities provided for the workshop?

YES	NO

5. Do you have any suggestions to improve the general organization of future workshop(s)?

……

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……

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……

Thank you very much for attending this very important workshop and we value your commitment and contributions made throughout the entire workshop.

Table of action/command words

Levels of learning

	Knowledge/comprehension		**Application**		**Problem solving**	
COGNITIVE	Arrange Cite Classify Convert Copy Define Describe Discuss Distinguish Explain Express Give ex. Identify Indicate Label List Locate Match Name	Order Outline Recall Recite Record Relate Reproduce Report Repeat Restate Review Rewrite Specify Summarize Tell Translate Underline	Apply Assemble Calculate Change Choose Compute Defend Demonstrate Discover Draft Dramatize Draw Employ Estimate Explain	Illustrate Infer Interpret Modify Operate Practice Predict Prepare Produce Relate Schedule Select Show Sketch Use	Analyze Appraise Argue Arrange Assemble Assess Categorize Choose Combine Compare Compose Conclude Construct Contrast Convert Create Criticize Debate Defend Devise Differentiate Discriminate Distinguish Estimate Evaluate Examine Experiment Explain Formulate	Illustrate Infer Inspect Interpret Judge Justify Manage Modify Organize Plan Predict Prepare Propose Question Rate Relate Recognize Score Select Solve Support Test Value Write

AFFECTIVE	Accept Accumulate Ask Describe Follow Give Identify	Locate Name Point to Respond Select Sensitive Use	Affirm Approve Assist Choose Complete Conform Describe	Perform Practice Propose Select Share Study Subscribe Discuss Follow Initiate Invite Join Justify	Act Adapt Change Defend Display Influence work	Integrate Mediate Organize Revise Solve Verify
PSYCHOMOTOR	Complete Demonstrate Distinguish Hear Identify Locate Manipulate Move Pick up Point to Practice	Press Pull Push See Select Set up Show Sort Specify Touch Transport	Activate Adjust Assemble Build Construct Copy Demonstrate Disassemble Disconnect Draw Duplicate Execute Load Locate	Loosen Manipulate Measure Open Operate Perform Remove Replace Rotate Select Set Slide	Adapt Combine Compose Construct Convert Create Design devise	Fix Generate Illustrate Modify Organize Plan Repair Service