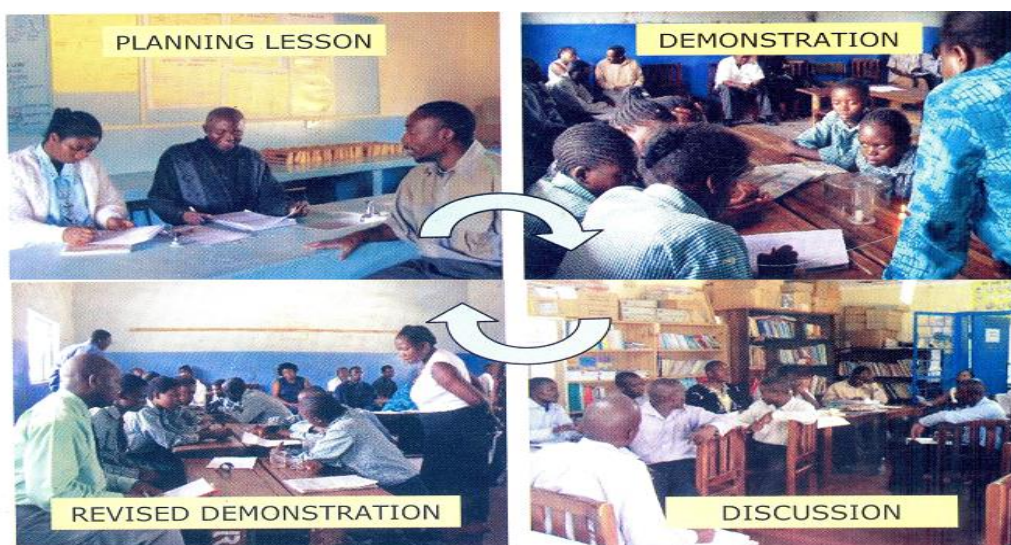




## ***CTM431: Chemistry Teaching Methods II***

### MODULE 2

*Opportunities to continually improve your personal resource, cognitive strategy and output in teaching*





Mukuba University  
Kitwe-Zambia  
Science Department

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## Acknowledgements

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## About this Module

This module is structured as outlined below.

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### How this module is structured

#### The module overview

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### Welcome to the module on Chemistry Teaching Methods

This module is the first part of the CTM431 Course in the Bachelor of Education Science programme. The module discusses: continuous professional development and the value of science subject associations. To complete this module successfully, you will need to spend three (3) hours per week studying the module, and make sure you work out all the activities in each unit. Don't move to another unit before you understand the previous unit. In case you need help contact the course tutors.

You are expected to do all the self marked activities and one tutor marked assignment which will accompany this module. You are required to submit the assignment to the nearest resource centre in your district. This module has five units.

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We strongly recommend that you read the overview *carefully* before starting your study.

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## Module outcomes



### Outcomes

Upon completion of this module you will be able to:

- Discuss the value of Continuous Professional Development.
- Identify the drivers of Continuous Professional Development
- Discuss the importance of the subject associations

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## Need help?



### Help

Should you require help in the course of your studies, do not hesitate to contact the following course tutors

Mr Mweshi E Cell: 0955-881340 / 0969-218224

E. Mail: [emweshi@yahoo.com](mailto:emweshi@yahoo.com)



## Getting around this Module

### Margin icons

While working through this module you will notice the frequent use of margin icons. These icons serve to “signpost” a particular piece of text, a new task or change in activity; they have been included to help you to find your way around the module.

A complete icon set is shown below. We suggest that you familiarize yourself with the icons and their meaning before starting your study.

 Activity	 Assessment	 Outcomes	 Note it!
 Summary	 Help		



## Unit 1

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# Continuous professional development

## 1.0 Introduction

In the previous units we looked at elements that are key to effective management of the Natural science department. In this unit will discuss the value of continuously develop your knowledge and skills that are key to your work as a chemistry teacher and the Continuous Professional Development (CPD) opportunities available to you within and outside school.

Thus upon completion of this unit you will be able to:



### Outcomes

- Define Continuous Profession Development
- Discuss the driver of CPD.
- Discuss the value of CPD to you as a teacher
- Identify the CPD opportunities within and outside school.

## 1.1 What is Continuous Professional Development?

Continuous Professional Development (CPD) is a continuous process of acquiring, improving and integrating knowledge, skills and attitudes for both personal development and career advancements. It encompasses all types of activities that provide learning opportunities for employees in an organisation to improve the tasks that define their profession.

Thus all the teachers in the department need to be given a variety of CPD opportunities to meet their personal and professional needs. Some of these needs are: personal or professional interest to keep up to date with new technology and practice, to advance one's career opportunities and to comply with professional regulatory organizations. The CPD activities include formal, non-formal and informal learning. The CPD activities should be based on Competence Based Education (CBE)

*Formal learning* is any training that lead to qualifications or credentials required to obtain or retain employment, these includes; post- initial education programmes and courses by educational institutions, in-service programmes and accredited courses by professional bodies.

*The non formal* CPD includes all the activities that are organised with a view to improve workers competences; they take the form of coaching and mentoring, on-the-job training, consultation and intervention. While the informal CPD encompasses all the forms of interactions within the working environment and public life that

gives an employee the knowledge, skills and attitudes to understand and improve his or her profession.

Let us now discuss the concept of Competence Based Education before we continue with our discussion about CPD.

### **Competence Based Education**

There has been a realization in the world today that the most important role of education is to equip workers with the ability to be innovative and creative in the use of knowledge and skills in order to adapt and contribute effectively to demands of the dynamic labour market. Thus there has a paradigm shift in education from knowledge to competence based education. Competence has a lot of meanings depending on the context in which it is being defined. However the concept addresses the following dimensions of an individual:

- *Personal resources*; the possession of knowledge, skills and attitude required to perform key professional tasks. This means that for you as a chemistry teacher you should possess the current chemistry pedagogy content knowledge
- *Cognitive strategy*; the ability for an individual to choose and use knowledge, skills and attitudes in a given context to perform. You should have the ability to use the knowledge, skills and attitude depending on the school environment in which you are to perform effectively
- *Individual's output*; the ability to perform at a desired level.

The focus of CBE is to develop attributes and nurturing of personal traits that will enable teachers to exhibit all the above dimensions of competence upon entering the labour market. The attributes are called competencies and are categorized as domain specific and generic competencies.

*Domain specific competencies refers to knowledge, skills and attitudes with specific content related to a specific profession, while generic competencies are needed in all content domains and are transferable, hence they mostly referred to as life skills.*

Thus Competence based education (CBE) is type of education that focuses on the development of competencies and uses the desired competencies not the disciplinary content as the criteria for the development CPD. The knowledge and skills in the CPD programmes are determined by the competencies that are needed by a competent professional of specific formulated professional profiles.

The roles of the competence based education is to; determine the disciplinary and functional aspects of a profession, develop principles and strategies underlying general skills, provide professions with an insight that teachers them how to apply knowledge and skills in different context, and develop the capability of learning how to learn.



## 1.2 Drivers for Continuous Professional development

Today's educational sector' macro environment is so complex and dynamic due to globalisation and information technology, these has put a lot pressure on a lot professions (teachers) to try and cope with the ever changing professional demands and competition. Thus Continuous Professional Development has become a critical component of Human Resource management and development of any educational institution in improving the adaptability, effectiveness and efficiency of its employees.

Like other professionals, teachers have a responsibility, to themselves and to their own profession, to deepen their professional skills, and keep themselves up-to-date on major developments affecting their profession especially in areas of pedagogy and subject content.

Teaching is a learned and a learning profession, and every teacher should also be a learner. Realizing that teachers needed to continuously improve on their teaching methodologies and content delivery and the fact that it is not possible to send all teachers for in- service training in the colleges; the Zambian government has put in place measures to enhance Continuous Professional Development (CPD)

The specific drivers for CPD in Zambia are:

- *Policy*: “Educating our future “,a policy document of the Ministry of Education has emphasized the need for CPD in education and has suggested that the strategic approaches for in-service teacher education should be:



- Programs that are demand driven, responding to identified needs
  - Programs which focus on school needs and are based in schools or Resource Centre's
  - Cost-effective programs which enable large numbers of teachers to have opportunities for learning
  - Programs which include not only studies on object contents but also methodologies, use of materials or way of management in classrooms
- 
- *New knowledge and technological advancement.* There has been increasingly emphasis on competence based education and technology enhanced learning thus there is need to train teachers in competence based teaching approaches.
  - *Career advancement.* There has been an increase in need for most teachers to improve their professional qualification and obtain higher qualifications. Most teachers are now not satisfied with certificate and diploma qualifications as this qualifications limits their chances of maintaining their jobs.
  - *Meeting the promotion criteria.* Most the teachers in Zambia today are perusing CPD programmes because they want to meet the minimum qualifications set to be promoted to certain positions. The minimum qualification for someone to head a secondary school is a bachelor's degree. Thus there has been an influx of serving teachers pursuing formal CPD programmes with a view of being promoted to management positions.
  - *Globalization;* professionals are now operating in a global village thus there is need for most of the teachers to upgrade to international standard.
  - *Organisational changes;* Due to turbulence in the macro environment in Zambia caused by political, economical, social, technological, environmental and legal forces our education system is constantly undergoing through various strategic changes in order to survive and adapt to the demands of these forces in the environment. It means that

there is need to constantly upgrading and retraining of the work force to cope up with the changes.

- *Increased emphasis on performance as the employment criteria*

*Very soon the need to obtain the practicing certificate in teaching will be one of the drivers for CPD in teaching profession after the establishing the Regulatory and accreditation body in Zambia; most professions like accountant, Human resource fellows and lawyers need to comply to the requirements of a professional regulatory organizations in order to practice. In Zambia a law graduate can only allowed to practice law after obtaining a practicing certificate from Zambia Institute of Advanced*

Now do the following activity



**ACTIVITY 1.2**

Among the drivers of CPD which ones do you think are the core of CPD in the teaching profession in Zambia? Justify your answer

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## 1.3 Continuous Professional development opportunities

There a lot of CPD opportunities available to you as chemistry teachers within and outside the school. Let us now discuss a few of those opportunities

### **CPD Opportunities within the School**

School-Based CPD targets a school as a venue of teacher professional development. A school is a place, where teaching and learning always take place. It is believed that the improvements are devised within the classroom. It is in the classroom where teachers are experiencing problems and concerns on teaching, and where educators should be at school with special focus on the classroom.

The Ministry of Education in Zambia has a clear policy for CPD as mentioned in the Educating our future (1996) which encourages INSET for teachers to be school based .It is from this policy document that all the levels of education provision are encouraged to provide necessary CPD for its human resources. Under school-Based CPD, each school is required to have Teacher Group Meetings (TGM) and Head teachers In –service meetings HIM regularly initiated by the Head of Department /Senior Teachers with the assistance of facilitators. The role of the School Head is that of creating a conducive environment/while the Deputy Head is responsible for the day to day teaching and, therefore, in –charge of School Based CPDs. Thus the role of the administration is very crucial in the planning and resource mobilization of the School Based CPDs.

The main actors in the meeting are the teacher's .They is free to discuss their concerns on teaching and to exchange knowledge and

skills in the groups. However, the experts from various educational institutions could be invited occasionally as observers.

The CPD opportunities at the school level are provided through the following activities

- Teachers Group Meeting (TGM) and Head teachers in service Meeting (TGM) in school program of in-service for the term (SPRINT) as a venue of learning of teachers.
- Grade Meeting at Resource (GRACE) and subject Meeting at Resource Centres (SIMON) are also considered as venues of workshops for stakeholders and facilitators. These types of meetings take place regularly throughout a year and are monitored by School in-service (SIMON) program. Teachers will be assessed on their performance based on their key areas which will include among other things their participation during school based CPD. The school Based CPD also works with subject Association as stakeholders for CPD activities. Subject associations will be discussed in the next unit.

School Based CPD has adopted lesson study approach. In the lesson study approach, one of the teachers in a school is requested to have demonstration lesson using pupils, while other members observe with specific tasks for analyzing the lesson. After the demonstration, a discussion on the lesson will be held to improve skills of members on conducting better lesson with some input from facilitators and other observers including pupils evaluations on the lesson. For every school term, a specific theme on key factors and components for effective lesson will be given to schools.



### ACTIVITY 1.3

Discuss the strength and weakness of school based CPD opportunities in your school especially for chemistry teaching

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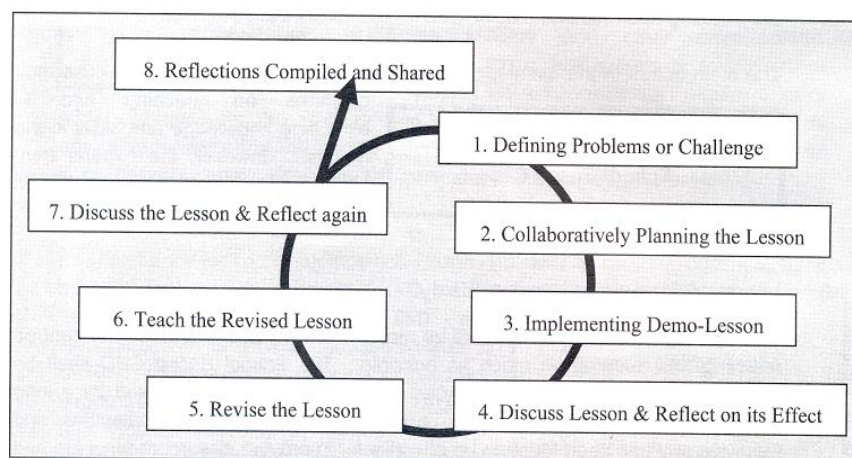
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Let us now discuss the lesson study as one the main avenue for school based CPD opportunities

## Lesson Study

Lesson study usually follows 8 steps of activities which forms a cycle as illustrated below.



**Figure 1.1** The cycle of lesson study at school

### *Defining the Problem or Challenge.*

As earlier stated lesson study is an approach which uses problem solving approach. Therefore it is very important in this approach to define the problem that will motivate and direct the lesson of the study group. This will allow teachers to voice out their challenges they have encounter during their teaching career and this marks the beginning of solving the problem. The problems to be identified will vary from general to specific ; others will have to deal with Ministry of Education policy, directives or curriculum and assessment issues to mention but a few.

### *Collaboratively planning the lesson*

In this session teachers will come together to plan for a lesson based on the identified needs in a collaborative nature. The teachers will often start planning the lesson by looking at the available resources such as reference books and articles produced by other

teachers who attempted to solve similar problems. Together they will develop and own the lesson plan.

*Implementing demo lesson* [seeing a lesson plan being implemented in a class while others observe]

Using agreed criteria; a teacher is selected to implement the lesson in a classroom situation while other teachers observe and evaluate the lesson based on specific items of concern. At this stage education standard officers as well as education experts will come in and observe where applicable together with the facilitators for a particular zone. The Heads as well as the Deputy Heads are encouraged to be in attendance

*Discuss the lesson and reflect on its Effects*

After the lesson the teachers will meet to discuss and reflect on the lesson. The discussion will mostly allow the teacher who was teaching to give his/her own critique of the lesson then followed by the other observes. The observers will share their observations. What is important at this stage is that the critique should not be centered on the teacher but of the lesson and suggests the improvements

*Revise the Lesson*

Together as a team, the lesson plan is revised based on the critique and reflections. Changes and adjustments are made and a new lesson plan is made ready for presentation to another class by the same teacher

*Teach the revised Lesson*

The actual situation in Zambia is that one teacher teaches the same subject to more than one class in a particular school. This therefore gives us an advantage to repeat the same lesson in a different class.



The lesson which was discussed together with reflections by the group is now taught by the same teacher but in a different class

*Discuss the lesson and reflect on its effects again*

It is very important that another discussion on the lesson could be done so that an observation of a change in the way the lesson is implemented could be observed even further amendments could be made again. However, minimal improvement should be appreciated. At this point the teachers can adopt such type of lesson plan for future use. If chance is available this trial of the lesson could be done although this is optional.

*Reflection compiled and shared (Teachers share reflections on new version of the lesson)*

At this moment progress report by respective stakeholders such as Teachers HODs, HOS, Facilitators, Heads and Standard Officers will meet at a common place such as a resource centre to exchange experiences from various schools. This will allow other districts to meet and share experiences at annual conferences for Subject Associations, SMASE and SMASTE. Further development of such materials be documented and published in journals or newsletters as alternatives which have worked.

### **CPD Opportunities outside the School**

There a lot of institutions that offer programmes to upgrade the academic qualifications of serving teachers in science in Zambia. The focus of the programmes offered by these institutions, like the University of Zambia, Kwame Nkrumah University, Mukuba University and Copperbelt University, focuses on formal learning. The programmes lead to mostly academic qualifications or credentials required to obtain or retain employment. While the in-service programmes with courses accredited by professional bodies are not there in science education.

The informal learning opportunities are also available inform of workshops, subject associations meetings/ conferences and societies like the chemical society of Zambia

**ACTIVITY 1.4**

(a) Lesson study emphasis so much on methodology not chemistry content. Discuss how this is a weakness of the programme

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(b) Why is that most the in-service programmes offered by learning institution mentioned above may not qualify as CPD

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## 1.4 Value of Continuous Professional Development (CPD) for teachers

The value of Continuous Professional Development (CPD) is about maintaining and improving the existing standards of teaching competence and professionalism in teaching/learning chemistry. The following are some of the values of Continuous Professional Development (CPD):

- Helps to acquire new skills to broaden competence and the enhancement of existing skills to keep abreast of evolving knowledge.
- To analyze the weaknesses and strengths in preparation of learning activity such as schemes of work, lesson plan etc.
- Acts as an in-service programme for graduates and serving teachers.
- Teachers learn new methodologies and approaches from other teachers coming from different institutions through interacting and sharing ideas during CPD meetings and workshops.
- It is so beneficial to some teachers in terms of acquiring new knowledge and skills of certain concepts that were not taught at higher institutions.
- Teachers with difficulties to teach some challenging concepts or topics in chemistry are helped by other teachers who are conversant with such challenging topics.
- Teachers from different institutions (within the district) move at the same pace e.g schools adopt to use same format of lesson plans and schemes of work.

- Increases confidence and understanding in teaching/learning chemistry of teachers and security in their existing knowledge.

## 1.5 Challenges Associated with Continuous Professional Development

The CPD programmes face challenges related to management, schools and teachers

- *Inadequate of teaching/learning materials and poor facilities.* There are not sufficient teaching and learning resources and internet facilities in schools
- *Most of the school managers are not committed to the development teachers professionally.* For a long time, teachers had not been viewed by the school management as people who needed improvement in their profession. Instead they were always expected to perform wonders in class with the basic knowledge they acquired from the initial teacher training.
- *Lack of mechanisms to monitor and appreciate the teachers' efforts in CPD activities (incentives mechanism).* Teachers are discouraged to develop themselves professionally in that appointments to higher position are not based on merit or professional advancement of a teacher (lack incentive)
- *Negative attitude of some teachers in understanding and appreciating the need to attend and carryout CPD activities.*

- *Lack of the professional bodies to regulate and accredit the teacher's qualification.*
- *Paradigm shift on perceiving workshops as a source of income.* A culture of perceiving workshops as a means of income has entered the minds of many people and teachers. Some donors and NGOs pay their participants well and some of the teachers attend such workshops, thereby, coming to CPD with such mind set

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## Unit summary



### Summary

In this unit we discussed that **Continuous Professional Development** (CPD) is a continuous process of acquiring, improving and integrating knowledge, skills and attitudes for both personal development and career advancements. It encompasses all types of activities that provide learning opportunities for employees in an organisation to improve the tasks that define their profession. The CPD programmes should be based on Competence based education that focus on the development teachers' personal resource, cognitive strategy and individual output. The drivers for CPD include personal interest, to meet the promotion criteria, upgrading of qualification and salary scales, globalization and trends in technology enhanced learning. The CPD programmes a valuable for you as a chemistry teacher in that they accord you with an opportunity to continuously develop your chemistry pedagogy content Knowledge.

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## Assessment



### Assessment

1. Discuss what is meant by Continuing Professional Development (CPD) and what it incorporates
2. Identify describe at least two CPD opportunities available for a chemistry teacher within the school.
3. Discuss your role in the school based CPD activities for chemistry teachers in your school



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## Unit 2

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### Science Subjects Associations in Zambia

#### 2.0 Introduction

Welcome to unit 4. In this unit we will discuss subject association and Junior Engineers, Technicians and Scientists (JETS) as some of the avenues available for as chemistry to continuous improve your knowledge and skills in chemistry teaching.

During and upon completion of this unit you will be able to:



#### Outcomes

- Discuss the science subject associations
- Identify the value of the subject association for you as a teacher.
- Discuss the short-comings of the subjects associations in Zambia
- Appreciate the objectives of JETS for teachers and pupils.
- Discuss the challenges faced by JETS in Zambia

## 2.1 Science subjects associations

There are quite a number of science associations in Zambia. Some of these associations include: Zambia Association of Science Education (**ZASE**), Zambia Association of Technology Education (**ZATE**), **and Zambia** Education for Science Teachers (**ZEST**), Zambia Agriculture Educators Association (**ZAGEDA**) **and** Zambia Association of Mathematics Education (**ZAME**).

At the moment ZASE is the most active and popular professional association among teachers (science educators). Thus, this module discusses the aims/objectives, structure of ZASE and the importance of science based associations to you as a teacher.

### Primary aims/ objectives

- To develop and sustain a national scientific capacity and provide highly skilled human resource for increased productivity in the economy.
- To foster national and international linkages for enhanced technology transfer.
- To facilitate the acquisition, adaptation and utilization of technology.
- Gender concerns in science and technology \_ this is done through three strategies:
  - Ensure that gender concerns are integrated at all levels of science development process.
  - Increase the number of girls who take up science subjects at all levels of learning.
  - Identify and eliminate factors that prevent females from progressing and excelling in science subjects.

- To ensure quality delivery of science education in classroom.
- Formulation of workable methods of teaching science.

### **Importance of professional science-based associations**

- Provides massive education programs such as SMASTE, SPRINT, DODI, SMARC and other continuous development programs.
- Provides forum for interaction between organizations that create, disseminate, and use scientific and technical information.
- Improves the quality, reliability, management and accessibility of importance to all fields of science and technology.
- Urges collaborative learning, research and publications of scientific knowledge.



### **ACTIVITY 2.1**

It has been observed that ZASE has failed to most its objectives  
Identify the factors that might have contributed for ZASE's failure  
to achieve its objectives

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## 2.2 What is JETS?

JETS is an acronym for Junior Engineers, Technicians and Scientists. This prestigious club has been set up to help pupils appreciate the impact of technological and scientific development to the overall development of the nation and citizens.

### **Background of JETS**

A JET in Zambia has been running for impressive 46-years. The organization was started by a group of eminent scientists in 1968 during a Zambia Association for Science Education (ZASE) meeting. During this meeting, the scientist seized the opportunity to coordinate school science clubs through a formal organization that they decided to call Junior Engineers Technicians and Scientist (JETS). The idea behind the formation of JETS was to popularize science and mathematics in schools.

### **Major aims**

- It aims to produce young technicians' engineers and scientists who will be able to deal with local technological and scientific issues.
- It also aims to explain the underlying causes of some environmental problems and offer possible solutions from a range of scientific and technological perspectives.

### **Mission**

To promote the production and display of high quality scientific and mathematical projects that provides solutions to local problems.

## Objectives

- To introduce learners to the principles, techniques and practices of engineering.
- To equip learners with a broad range of engineering skills that will be essential in future academics work.
- To assist the learners in building up their ability to analyze and solve scientific and technological problems.
- To teach learners how to acquire practical skills that will be of value to their future employers.
- These objectives are being met through the ever popular JETS fairs promoted by many schools at district, regional and national level.

## Who Runs JETS

The structure of JETS is similar to that of ZASE. In Zambia, secondary schools run JETS at district, regional and national level. The head of department natural sciences (HOD) by virtue of him being in that position should coordinate the JETS activities in school.

## Challenges faced by JETS in schools

- The JETS is not part of core curriculum but it is simply a part of the extra curriculum hence teachers and pupils have a negative attitude towards JETS they think is a waste of time.
- It is run like a club hence commitment depends on ones interest.
- Lack of collaboration between school management and teachers in charge.

- There is a gap between Jets and the world of research at higher academic level.
- Teachers lack skills to identify and enhance talent and link their learners to associations with similar passion.
- Lack of support from the academic and labour market to sponsor and develop the projects further. Pupils' good projects end up in the shelves.

### **Solutions**

- To expose teachers to professional interactions so that they can be able to identify talent and link their learners to individuals or associations with similar passion. It is important for you as a chemistry teacher to join societies like chemical society of Zambia
- To encourage teachers in charge to lobby administrations to provide support.
- To promote and encourage team work among science teachers.
- Motivate learners by providing both tangible and intangible rewards so as to stimulate and sustain interest.
- Depends on the management and leadership styles of the coordinator at individual schools.
- There is need for JETS co-coordinators to partner with higher institutions of learning and business houses to sponsor the and develop the projects



**ACTIVITY 2.2**

If you analyze the way the projects identified and presented by pupils during the JETS do they serve their purpose as stated in the objectives of JETS? Justify your answer

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## Unit summary



### Summary

In this unit we have discussed There are quite a number of science associations in Zambia. Some of these associations include: Zambia Association of Science Education (**ZASE**), Zambia Association of Technology Education (ZATE), **and Zambia** Education for Science Teachers (**ZEST**), Zambia Agriculture Educators Association (**ZAGEDA**) **and** Zambia Association of Mathematics Education (**ZAME**). These associations are available for you as the avenues for you to continuously widen your knowledge in science and technology. The scientific world is so dynamic you need to keep abreast of the trends in chemistry education and the application of chemistry in various sector of the economy. It is in this view that as a teacher you should take keen interest in JETS so us you can pupils appreciate the impact of technological and scientific development to the overall development of the nation and citizens.

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## Assessment



### Assessment

1. Discuss the value of JETS activities to you as a chemistry teacher and your pupils
2. Briefly describe the achievements of JETs in the past five years
3. Identify the contribution of ZASE to the CPD of chemistry teachers and chemistry curriculum in Zambia if any.

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## **Answers to Activities and Assessments**

- **These have NOT been provided due to the descriptive nature of most the answers in this module**
- **If you are not sure of the answer go back and study the section of the unit where the question came from, You will definitely find the answer there.**

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## Readings

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