PRIMARY SCHOOL SCIENCE AND MATHEMATICS
TEACHER PROFESSIONAL DEVELOPMENT MODULE 2022

ISO 9001:2015 CERTIFIED

CENTRE FOR MATHEMATICS, SCIENCE AND TECHNOLOGY EDUCATION IN AFRICA

(CEMASTEA)

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Approved for circulation

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CEMASTEA (2022) Training module for Primary school mathematics and science teachers

CEMASTEA: Nairobi, Kenya

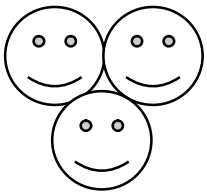
Table of Contents

Acronyms and Abbreviations

CBC	Competency Based Curriculum
CBA	Competency Based Assessment
CEMASTEA	Centre for Mathematics, Science and Technology Education in Africa
CPD	Continual Profession Development
HOTs	High Order Thinking Skills
ICT	Information and Communication Technology
INSET	In-Service Education and Training
KICD	Kenya Institute of Curriculum Development
KNEC	Kenya National Examination Council
M&E	Monitoring and Evaluation
MoE	Ministry of Education,
Q/A	Question and Answer
SMASE	Strengthening of Mathematics and Science Education
TPD	Teacher Professional Development

Symbols

The following symbols will guide trainers and trainees as they go through the training. They have been adapted from UNESCO's training manual on Quality Gender-Responsive STEM Education- 2018.

Symbol	Meaning
	Participants to reflect on the issues at hand either individually or in groups. Guidance will be provided by the facilitators
	Participants to work and report on a given activity as a group.
	A question to be answered by participants. They may work on the questions either individually or in groups. Guidance will be provided by the facilitators
	Expected or possible responses to a question posed
	Enclosure for an activity to be done by participants either individually or in groups or for possible responses to a question posed. It is used in combination with other symbols.

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Welcome Remarks by the Director

Ladies and Gentlemen,

I take this opportunity to most sincerely welcome you to the 2022 Online County INSET for Primary school teachers. This is one of CEMASTEA's teachers' professional development activities in 2022. The two week's training targets 3,008 mathematics and science teachers drawn from Primary schools in all the 47 counties. This year, we have adopted the continued use of online platforms to implement this INSET for enhancing skills to leverage on online platforms for teaching and learning.

Ladies and Gentlemen,

There are several reasons why INSET is worth the time and effort in education. In-service education and training act as a catalyst for teacher's effectiveness. It is also a way of updating teachers' skills and knowledge for improving teaching and learning which in turn leads to better job performance. In-service training is important for teachers to face new challenges and changes in the education world. In-service training is also a fundamental undertaking to improve teacher professionalism.

Ladies and Gentlemen,

The theme for this year's INSET is 'Enhancing teachers' pedagogical content knowledge in digital literacy through collaborative lesson planning for effective implementation of Competency Based Curriculum (CBC)'. Therefore, during this training, you have the opportunity to enhance your knowledge, skills and attitudes on digital literacy and practice collaborative lesson planning and implementation. This will enhance your competence in promoting digital literacy among learners and effective implementation of Competency Based Curriculum (CBC). This is very important particularly now that education reforms in Kenya are focused on effective implementation of CBC.

This training will also strengthen your capability for leveraging on online platforms for teaching and learning; especially the Google Classroom and Microsoft Teams. This is crucial especially now when blended teaching and learning has become a necessity and a preferred mode of teaching and learning.

Ladies and Gentlemen,

Upon successful completion of this training you will implement the skills in your own classroom as a practitioner. This places a great expectation upon you as your learners will expect improved learning and ultimately better learning outcomes. I therefore request you to dedicate your time to the training for you to be successful in executing your role in teaching and learning.

Ladies and Gentlemen,

In conclusion I want to urge all of you to take this training seriously. I wish you fruitful deliberations in the course of the training..

Thank you

JACINTA L. AKATSA, HSC

DIRECTOR, CEMASTEA

Prologue to the Training

Science, Technology, Engineering and Mathematics (STEM) education constitutes a critical enabler to the President's Big Four Agenda since skilled human capital is a key driver for socio-economic and technological development. Therefore CEMASTEA, as a Centre of Excellence in building capacities in STEM education has an important role in the identification,development and nurturing of STEM talents in the early years through middle school to senior school. This will create sufficient pool of learners with interest in pursuing STEM related courses in higher education, and subsequently pursuing STEM related careers. As a Centre, we recognize the critical role of the teacher in this endeavour.

We are also aware that the need to transform teaching to achieve 21st-Centurylearning outcomes as embodied in Competency Based Curriculum (CBC) and `Competency based Assessment (CBA) is continually placing new demands on teachers. This has been compounded by the outbreak of the COVID-19 pandemic that has continued to disrupt learning thus putting an extra burden on teachers of how to ensure continuity of education in spite of the pandemic. Therefore for teachers remain relevant in the face of ever-evolving education systems,keep abreast of emerging trends and technological advancement, and effectively continue facilitating learning in the face of emerging global disruptions; teachers need to upgrade their pedagogical skills.

CEMASTEA appreciates the fact that teachers are generally quite competent in their work. However, the methods we use are sometimes severely limited. The efforts of the Centre therefore focus on changing teaching rather than the teacher. Changing teaching can only be achieved by providing teachers with opportunities and appropriate support structures that encourage the critical work of on-going improvement of pedagogical practice. This is why this training is designed to provide you with a range of professional learning opportunities such as engaging in reflective practice; enhancing pedagogical content knowledge; and exploring how ICT integration and digital literacy can be used to mitigate challenges in facilitating learning.

Previously our trainings were conducted face to face. However, it is not practical to do so this year because of the challenges arising from the COVID-19 pandemic. Therefore, just like the 2021 Primary INSET will be implemented through virtual learning management system platforms. We will implement it at two levels: national and county levels. As teachers of Mathematics and Science, you will go through this two-week county level training which you will be expected to implement in your classroom. We shall have both synchronous (live, concurrent) sessions and asynchronous (independent, self-directed) sessions. Synchronous sessions will be conducted using microsoft teams video conferencing tool while the asynchronous sessions are posted in this Google Classroom.

For this training to be successful, you will have to demonstrate commitment and dedication during the two weeks. We therefore appeal to you to spare time during the two weeks training to gain vital skills that will have a long term effect on your classroom practice and benefit your learners. You will need to be very keen so that you gain as much as possible to improve your own skills. After the training, make it a priority to use the skills you will have acquired to improve your classroom.

We wish you a successful training and hope that you will enjoy and find it valuable

Patrick A. Kogolla
Ag. Deputy Director Training

Introduction

The theme of the 2022 Primary INSET is 'Enhancing teachers' pedagogical content knowledge in digital literacy through collaborative lesson planning for effective implementation of Competency Based Curriculum (CBC)'. This training contributes to the realisation of Teachers Service Commission's (TSC) policy of continuously equipping and improving teachers' competencies for enhanced learning outcomes in Kenya. The course is designed to enable teachers to meet requirements by the TSCs' Kenya Professional Teaching Standards (KePTS) of enhancing teachers' competencies in Pedagogical Content Knowledge (PCK) and remote learning methodologies. The training also aims to enhance teachers' understanding of the Competency-Based Curriculum (CBC) and Competency Based Assessment (CBA).

The following is a guide on the course content and the due date for completing the various tasks and turning in the work:

Week 1:

- Welcome remarks
- Levelling expectations
- Objectives and Guidelines
- Netiquette; Online Safety;
- How to Navigate Google Classroom
- Opening ceremony
- Digital literacy for teaching and learning mathematics and science
- Session Evaluation

Week 2:

- Subject sessions on Digital Literacy
- Action planning and Way forward
- Overall INSET Evaluation
- Closing ceremony

Please note that in order to successfully meet the targets for online learning promptly, a high level of self-management and personal planning is required. We look forward to exciting learning experiences.

Course Theme

'Enhancing teachers' pedagogical content knowledge in digital literacy through collaborative lesson planning for effective implementation of Competency Based Curriculum (CBC)'

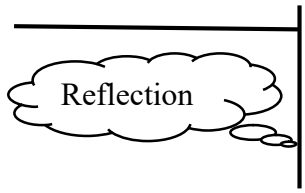
Rationale

The 2022 Primary INSET will be conducted virtually. The shift from face-to-face to online training has been adopted as one of the strategies to continue with CEMASTEA training programs. Working from home and working online is part of necessary adaptation in training. Therefore, the Online 2022 primary INSET provides you an excellent opportunity to gain and probably teach others some digital literacy knowledge and skills for teaching and learning.

Expected Course Learning Outcomes

By the end of the training, you should be able to:

1. Navigate and use the Google classroom in the learning process
2. Develop teaching and learning resources that can be used to promote digital literacy in mathematics and science
3. Collaboratively analyse the curriculum materials and prepare lesson plans that integrate core competencies and model values in the sub-strands Coding and Geometry
4. Appreciate the benefits of collaborative lesson planning in the implementation of CBC



Activity 1

Share some of your expectations concerning this training.

(Upload your responses in the Google classroom)

Netiquette, Guidelines and Online Safety

1. **Be respectful -** keep in mind the feelings and opinions of others, even if they differ from your own. ***If you wouldn't say it to someone's face, don't say it online either.***
2. **Be aware of strong language, all caps, and exclamation points –** by being cognizant of strong language, you can identify potential confusions before sending messages. ***Tip: Read everything out loud before you send it.***
3. **Be careful with humor and sarcasm –** make sure that it is clear you are being funny and not being rude. Just remember to keep the smiley faces away from academic papers.
4. **Mind your grammar and spelling –** your written communication should be professional and reflect proper writing style.
5. **Cite your sources –** if you read a great thought in your text, share it, but be sure you let your audience know where you saw it first. That is cite that source
6. **Don't post or share (even privately) inappropriate material – n**othing is truly private online.
7. **Be forgiving –** try to be understanding of others when they struggle with written communication. It is very different than simply talking to a person face-to-face

ALWAYS REMEMBER:

a. When posting on the Discussion Board/ forum, you should:

- Make posts that are on topic and within the scope of the course material.
- Take your posts seriously and review and edit your posts before sending.
- Always give proper credit when referencing or quoting another source. (Don't copy and paste another participant's post and claim it as original.
- Read all messages in a thread before replying and open minded
- Don't repeat someone else's post without adding something of your own to it.
- Avoid short, generic replies such as, "I agree." You should include why you agree or add to the previous point.
- Be respectful of others' opinions even when they differ from your own. When you disagree with someone, you should express your differing opinion in a respectful, non-critical way.

b. When participating in a chat (chatiquette) observe the following:

- If the facilitator posts 'STOP' then do not post a message until he asks the forum to 'START' posting.
- If you want to send a post to just one person in the chat room, then write an @ sign followed by the person's name followed by your message. For example, @Peter: That's very funny! Alternatively, you can click the 'Chat' button under their picture in the right hand column. Their name automatically appears in your text field.
- Emoticons are available in chat. However, excessive use of emoticons is distracting.
- Do not write with the CAPS lock on as this is considered shouting.
- If you have a lot to say don't try typing it all in at once because while you are typing, the conversation continues without you. Instead, type in part of what you want to say followed by ". . ." to indicate that there is more coming.
- If you have a question, use a question mark "?".
- When the facilitator asks a question, reply with: 'Yes', 'Got it', or 'Right'.
- Be patient. Don't repeat yourself. Instead, wait for a reply to your post. Remember, some people type slowly.
- Don't idle or lurk in a chat room. Do take part in the conversation. If you are going to be away from your computer for a short time, tell the other users.

- If you disagree with something someone says during a chat, be diplomatic and polite in answering. Try to find the good points made, acknowledge them and then respectfully describe the areas where you disagree.

Guide to Keeping Students Safe Online

Teachers need to communicate to their students on how to make smart decisions online especially while using learning platforms such as google classroom for their remote learning.

What is online safety for students?

It entails equipping students with adequate knowledge on how to protect themselves when accessing the internet, informing them of the risks associated with working online while highlighting its benefits too.

It is also commonly known as internet safety, e-safety and cyber safety.

Why is online safety

Working online is something we probably do unconsciously on a daily basis; this has exposed individuals to potential dangers such as the risk of their information being accessed or unsafe communication with unknown parties.

As teachers explore remote learning, questions they should ask themselves is; which types of dangers are the children likely to become exposed to when they are accessing the internet content and are they knowledgeable enough to stay safe?

As teachers work online with their students, they should endeavor to find a balance between ensuring online safety and allowing students to maximize on the educational resources the internet has to offer. Since most of the assignments/projects given will rely on using internet resources such as google, YouTube, it is crucial students know what makes a website off limits.

How can teachers Keep Students Safe Online?

1. As a teacher one must understand the meaning of online safety, learn about online child safety laws and find out how you can educate your students on the importance of staying safe online.

   A Guide to Child Online Protection https://www.ca.go.ke/wp-content/uploads/2019/06/COP-Booklet.pdf

2. Create private online learning communities among teachers, parents and students. It can be a platform for sharing and educating each other on how to keep safe online. It can also serve as a platform on any online security alert.
1. Provide parents with notice of the on going online teaching and learning activities and obtain parental consent before collecting and using any child's information.
2. Having students sign pledges and posting them on the platform being used in this case google classroom is a great way to enhance students' accountability for their own online safety. It will also serve as a constant reminder to students of the knowledge they have about internet safety. As a class you should come up with rules and guidelines for expected online behaviour that all should promise to adhere to.

3. Talk to the students about digital footprints. Information and action performed on the internet may become public and may come back to haunt them since the 'internet never forgets'. Emphasize the dictum that Think Before you Post or share anything on the internet.
4. Educate parents on online safety. Let them know the dangers of inappropriate internet usage by their children and ensure they implemented parental control on sites visited. Advise the parents to bookmark safe sites that the children can visit to access information.
5. Stick with websites verified for use by children to access resources such as;
    a. https://ed.ted.com/
    b. https://www.khanacademy.org/
    c. https://www.youtubekids.com/
    d. https://www.kiddle.co/
    e. http://www.kidzsearch.com/
    f. https://scholar.google.com/

6. As a teacher, live by example; ensure you maintain a flawless social media life. Keep your profile private and ensure the content you share is free from inappropriate language or content.

How can Parents keep their child Safe Online?

1. Use a Virtual Private Network (VPN). This will prevent predators from tracking your child's location online. A VPN uses an encrypted connection thus securing your data from unauthorized access.

    What is a Virtual Private Network https://www.cisco.com/c/en/us/products/security/vpn-endpoint-security-clients/what-is-vpn.html

2. Install a strong anti-virus solution to protect your computer from viruses and malware attacks. Consider putting in place strong passwords securing your machine. Consider using a password with a combination of Caps, Small letters, characters, numbers e.g. StaySafe2020!
3. Keep the computer Operating System and all software updated.
4. Be cautious of neither downloading untrustworthy contents nor visiting such sites.
5. Monitor the sites the children are visiting and who they are talking to. Be on the lookout for cyber bullying or people impersonating you, your friends and family. Attend the online classes with your child as often as you can. Have the computer placed in a central location where it is easy for you to keep an eye on their activities.
6. Use parental control features to keep them away from illegal content and accidentally stumbling into something unsafe. For example, the Safe Search Filters feature on Google will block sites with explicit sexual material.
    a. How to turn off/on google safe search https://www.youtube.com/watch?v=ImvcUjv_eCs
    b. You can also find these parental control features mostly in antiviruses or a downloaded application. You can also opt to purchase one.
7. Block third party cookies to prevent the websites visited in your computer from monitoring your activity. Here's a guide that explains how to easily block cookies in any browser;

    https://www.kaspersky.com/blog/how-to-block-cookies-in-chrome-safari-firefox-edge/43505/

8. View your children's browsing history. Open the browser of your choice, press ALT + S key on the keyboard and a drop down menu will appear with a list of previously visited sites. Also do a regular check on deleted files in the recycle bin.

9. To effectively ensure the safety of your child online, know their technological skill level. It will be the only way as a parent you will be able to teach them on online safety and not assume they don't know.
10. Take the initiative of training yourself and your children on online safety measures.

    Consider visiting https://pixelprivacy.com/resources/keep-children-safe-online/

How can students keep themselves Safe Online?

1. Never share personal information like your home/school address, parents/your phone number, your daily planned activities
2. Only accept friend requests from people you know, or join classes/groups created by your teachers.
3. Ask for your parent consent before joining any classroom, group, discussion forums.
4. Never post anything you wouldn't want your parents/teachers to see nor one you would feel embarrassed about.
5. Speak up if you notice a classmate posting content in the classroom that is not appropriate or is cyber bullying fellow classmates.
6. Never share online passwords with anyone (friends or other people).
7. Make a habit of changing your passwords frequently like once a month.

Conclusion

Let us enjoy online learning in a safe environment

UNIT ONE: Navigating the Google Classroom

Introduction

Google Classroom is a free web service developed by Google for schools. Its aim is to simplify creating, distributing, and grading assignments for students. The primary purpose of Google Classroom is to streamline the process of sharing files between teachers and students. The ease in use makes it a favourable platform for both asynchronous and synchronous learning. The Google meet can be incorporated in the Google classroom for real-time meetings.

Rationale

There is a need to embrace an alternative approach to training different from face to face to ensure continuity of learning in instances of disruptions of learning due to unpredictable natural occurrences. To realize this, teachers should be conversant with the existing Learning Management Systems (LMS). An LMS is flexible, and allows people to work from anywhere, anytime due to its flexibility. Because of this, teachers can be trained from home, even outside school hours. This content is aimed at enhancing teachers' ability to use the Google classroom as a Learning Management System in teaching and learning.

Learning Outcomes

By the end of this unit, the participant should be able to demonstrate ability to:

i) Navigate through a given Google Classroom
ii) Upload responses in the Google Classroom
iii) Grade students work in the Google Classroom
iii) Appreciate the use of Google Classroom as a Learning Management System

Navigating through a Google classroom as a student

The Primary National INSET content has been made online through the Google Classroom. To access the content in the Google classroom, you need to login to your Gmail account, and follow the steps below:

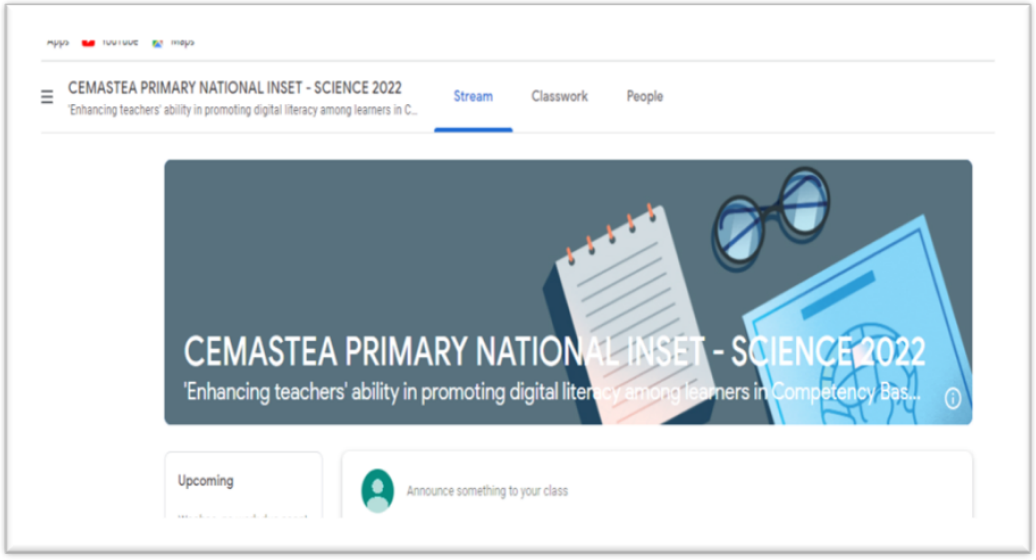
- Log into your Gmail account
- Respond to the email with the following Subject:
- **Class invitation: "CEMASTEA PRIMARY NATIONAL INSET – SCIENCE 2022 Enhancing teachers' ability in promoting digital literacy among learners in Competency Based Curriculum and Competency Based Assessment"**

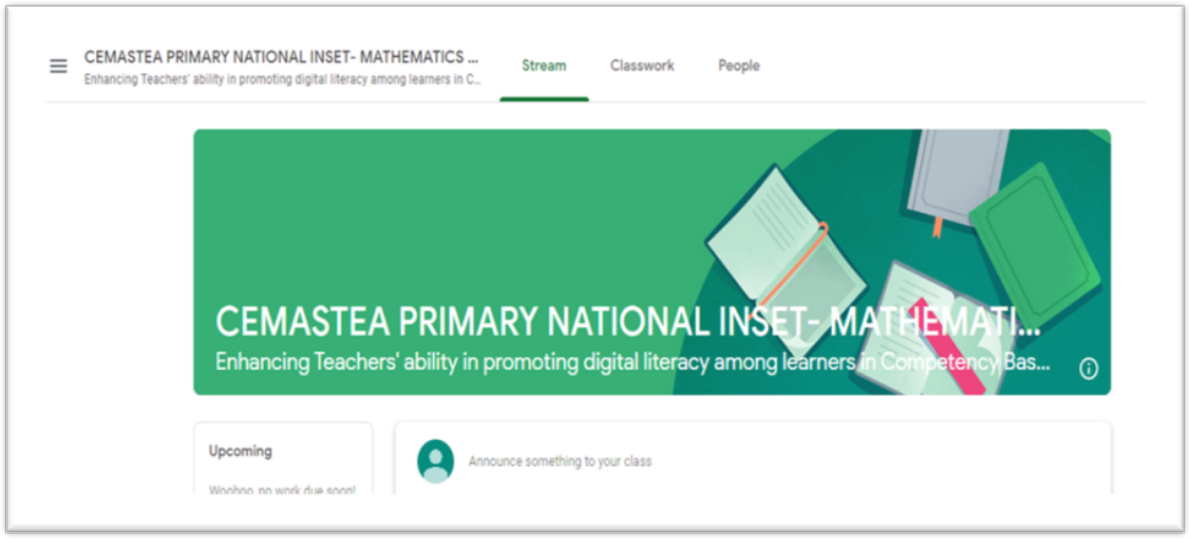
  Or

- **Class invitation: "CEMASTEA PRIMARY NATIONAL INSET – MATHEMATICS 2022 Enhancing Teachers' ability in promoting digital literacy among learners in Competency Based Curriculum and Competency Based Assessment"**
- Click the 

button to accept the class invitation

This takes you to the Class Home Page called the 'Stream'





a) The Tabs

The Google classroom is easy to navigate through. There are three tabs that you will use on the Class Home Page to navigate through, namely, **"Stream," "Classwork,"** and **"People".**

The **"Stream"** tab shows statements posted either by the teacher or the students in the class. Here, a person makes class announcements and comments. Teachers also share their comments and even resources.

The **"Classwork"** tab shows the content broken down into learning activities. Here you will find resources for reading as well as tasks and assignments you are supposed to respond to and their timelines. Where necessary, marks may be attached to specific tasks. Students should read all the materials and respond to all tasks and assignments.

The **"People"** tab shows the teachers (facilitators) and classmates (students) enrolled in the class.

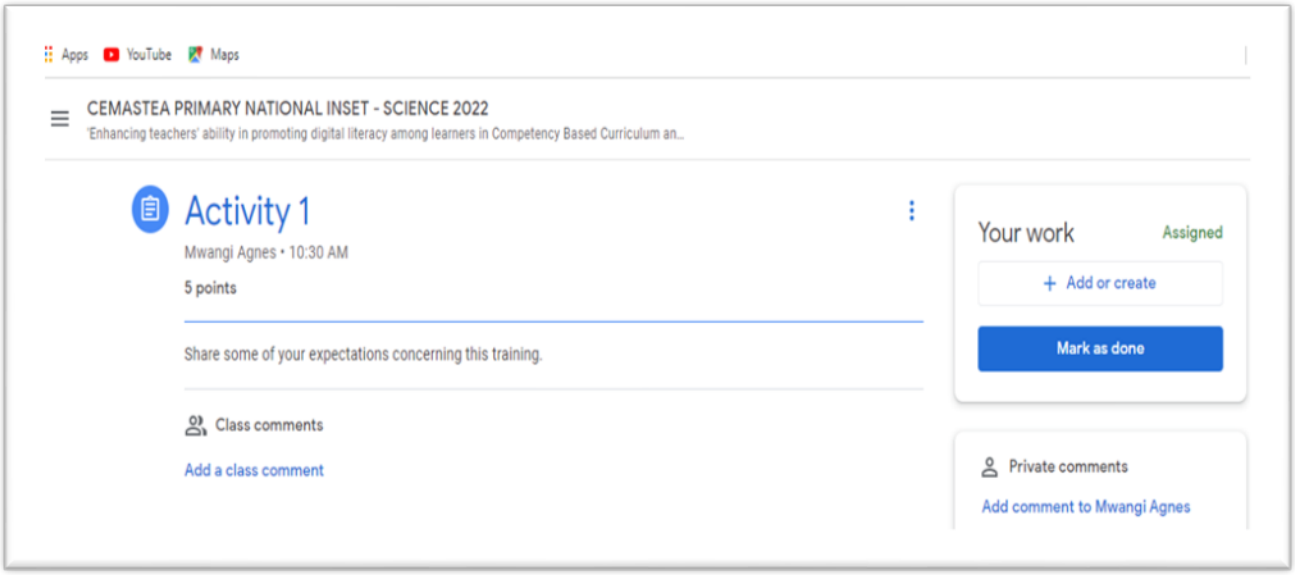
b) **Viewing classwork content/tasks**

To view the tasks in the Google classroom, click on the classwork tab, then click on various tasks by clicking either ***view assignment, view question, or view material***. This allows you to read the material posted and/or respond to the task.

c) Responding to the tasks

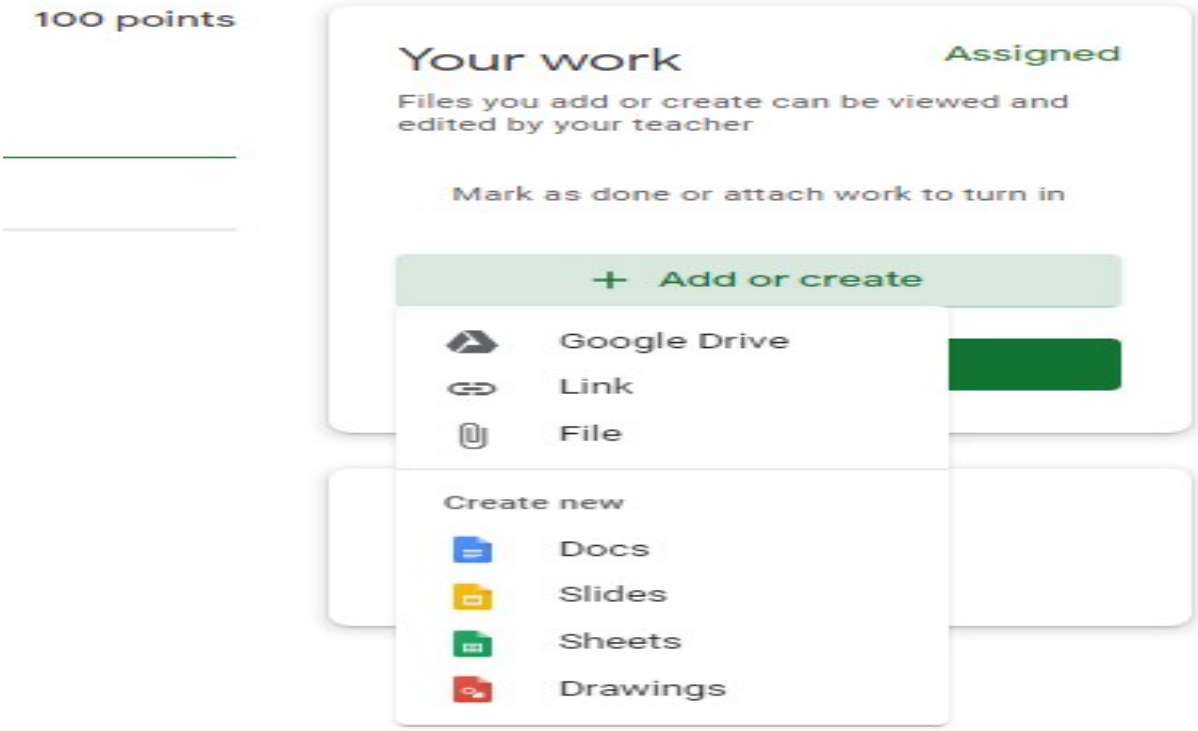
Under the classwork tab, click on any activity to view e.g. activity 1. You will see *"class comments"* and on the right *"your work"*. You are expected to post your work under *"your work"* section.

Click on ***"+ Add or Create"*** icon to get 7 options to use for your answer. You can also type a private comment to your teacher (facilitator).

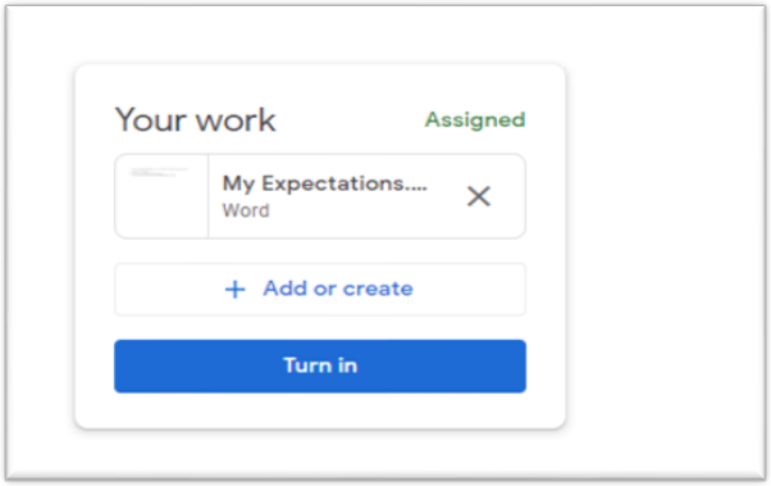


d) Posting your response

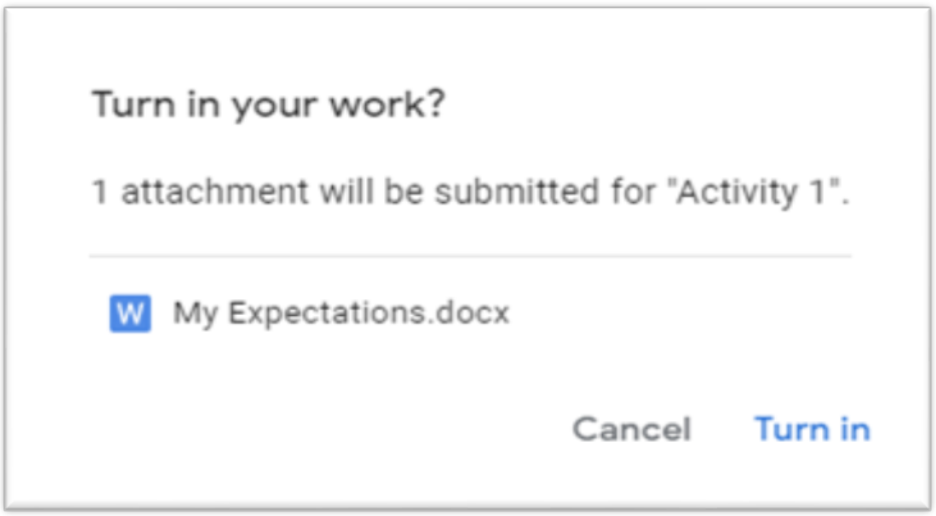
When you click on ***"+ Add or Create"*** icon, the following drop down menu showing the 7 options appears.



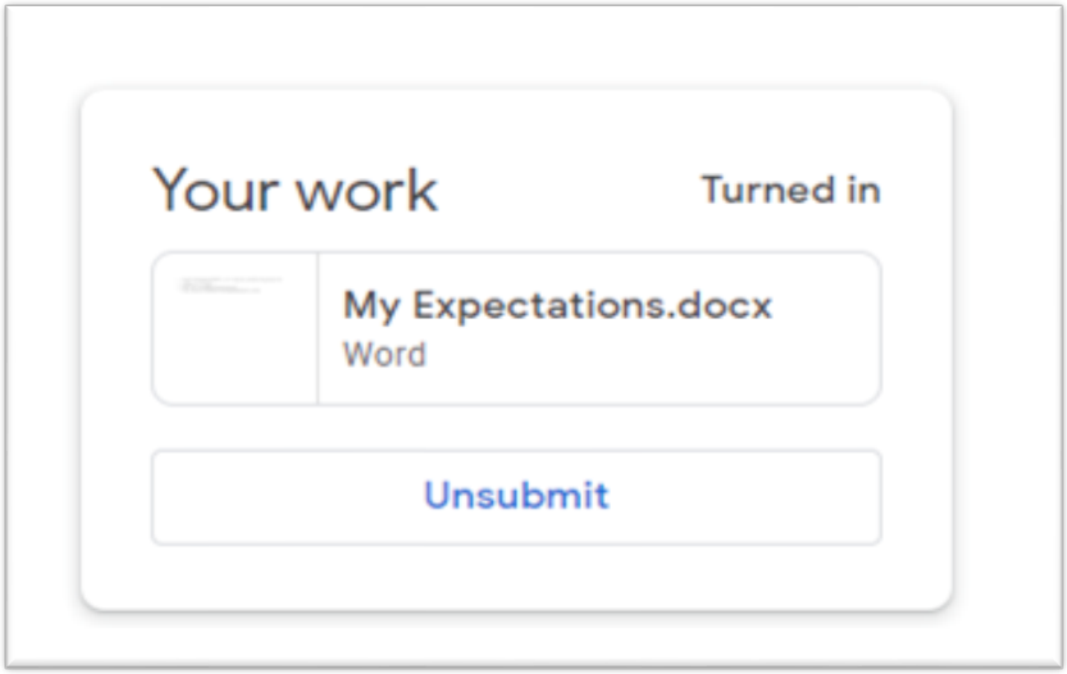
- The options are
  - **Google Drive** – clicking it takes you to your Google drive to select a resource stored there
  - **Link** – clicking gives you an options to paste a link
  - **File** – clicking gives you an option to add a file from your device (computer or even your Google drive)
- Creating New
  - **Docs** – clicking creates Google docs (word processor) where you can write your response and post
  - **Slides** - clicking creates Google slides (presentation) where you can write your response and post
  - **Sheets** - clicking creates Google spread sheets where you can write your response and post
  - **Drawings** – Gives Google drawing- you can draw diagrams, paste or insert pictures, etc.
- After selecting the appropriate option and responding to the task, complete the assignment by clicking '*Turn in'*.



- After clicking '*Turn in*'**,** this pop-up window will emerge.



- Click "Turn in" to submit your assignment.
- After submitting your work, this window will emerge.



- To edit your work, you can always click *'Unsubmit'* icon and edit.

Navigating through a Google classroom as a teacher

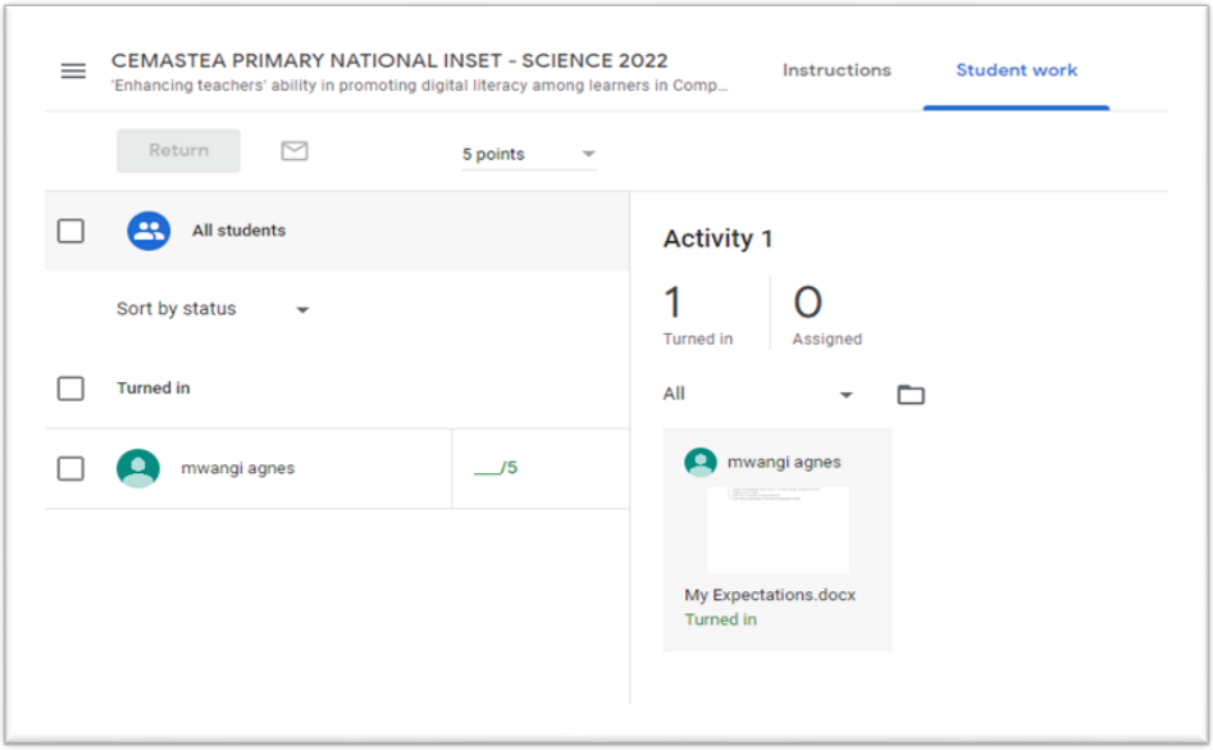
There are four tabs that you will use on the Class Home Page to navigate through, namely, **"Stream," "Classwork," "People",** and **"Grades"**

Grading students' work

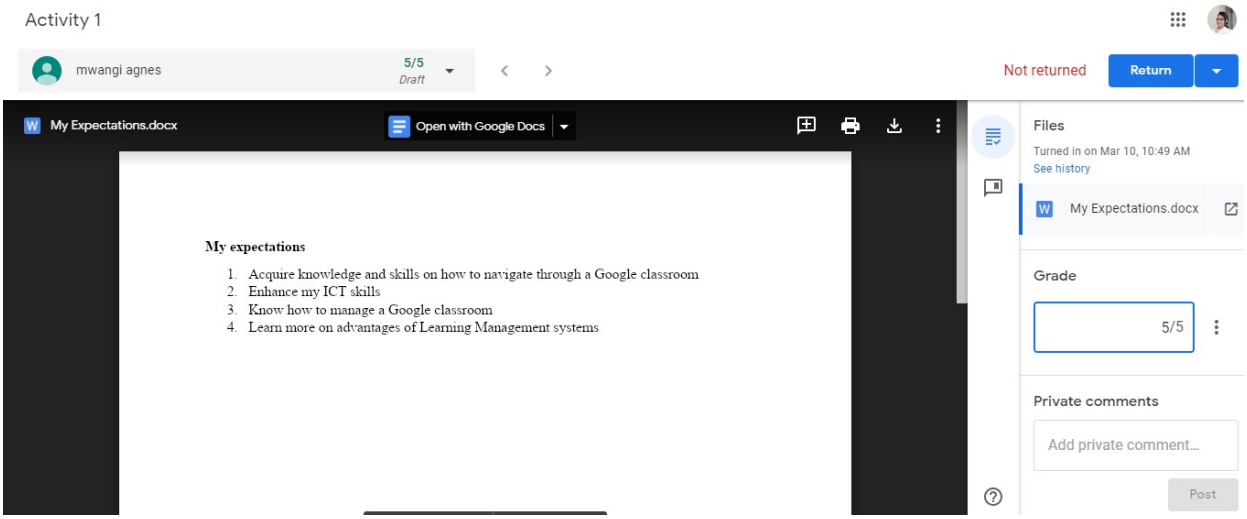
When the students submit their work in the Google classroom, the teacher will need to mark the assignments, grade and return the grades to the students. As a teacher in the Google classroom, you will need to:

- Click on the classwork, activity, then view assignment.

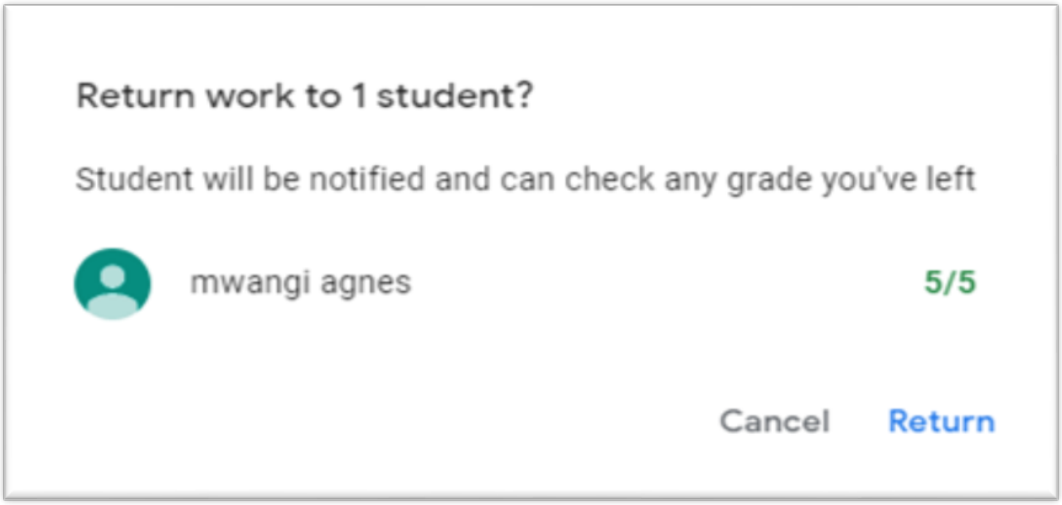
- This allows you to view the turned in work. Click on the 'turned in' to open.



- The file opens and allows you to mark the work and award the student a grade.



- Click 'return' to return the grade to the student. The student will be notified that you have marked and graded the work.



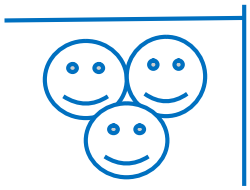
b) Generating students grade book

c) Creating a Google classroom

d) Creating content in the Google classroom

Note: Activity 1 is a practice activity in the Google classroom

Activity 2 (Asynchronous)



Activity 2: Creating a Google classroom

Use the skills you have gained in this session to carry out the tasks listed (in case of any challenge, watch the video attached in the Google classroom).

1. Create individual Google classroom

a. Give it a name: Your name>School>Class
b. Class Description-Describe briefly what your class is about
c. Room: Indicate one of your classes e.g. 4 North
d. Subject: Indicate your subject for this class

2. Open the classwork page and create the following

a. Create a topic
b. Introduction to your topic
c. The objective

3. Under topic place the following:

a. Lesson 1 Subtopic
b. Lesson learning Activity 1
c. Lesson learning Activity 2 etc.
d. Create assignments and set due dates
e. Attach Word document of reference notes, worksheets, videos (if any), relevant links, lesson plan etc.

f. Resources such as an attached lesson plan or a power point presentation of a lesson

4. Invite two colleague teachers as co-teachers and three other colleague teachers as students in your Google classroom.

NB: You can practice the following:
a. Emailing all students
b. Grade and return
c. Exporting students grades to an excel sheet
d. Create a quiz using Google form
e. Removing students from class
e. Muting student comments

For this activity, submit the screenshots of the stream page, classwork page, and people page of your created Google classroom in the Google classroom where you are invited as a student.

Conclusion

Google classroom as a Learning Management System provides a teacher with a way to create and deliver content, monitor student participation and assess students' performance. It also provides students with the ability to use interactive features such as discussions, chats and video conferencing through Google Meet. Other examples of Learning Management Systems include Moodle, Microsoft Teams among others.

UNIT TWO: Digital Literacy for Teaching and Learning Science and Mathematics

Introduction

Welcome to Unit Two of this Module which is on digital literacy for teaching and learning of mathematics and science. You will discuss the meaning of digital literacy, identify digital tools and create digital resources that can be used for the learning process. You will also have an opportunity to identify a given concept in mathematics or science and effectively use an identified digital resource to demystify the concept so as to enhance learner's understanding.

You will be expected to proceed to analyse curriculum designs and textbooks; integrate and assess core competencies, core values and PCIs when lesson planning. In science, the strand on Digital Technology, and more specifically the sub-strand of coding will be used to demonstrate how the competency of Digital Literacy can be enhanced. While in Mathematics, the strand of Geometry shall be used.

Rationale

Digital Literacy is one of the core competencies being enhanced in teaching and learning through the Competency Based Curriculum. In the course of curriculum implementation, teachers are expected to nurture learners to demonstrate digital literacy. For learners to acquire this competency, teachers

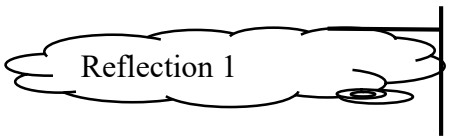
require capacity building to harness the power of technology. This unit is therefore aimed at enhancing your understanding on digital literacy and how it can be used to enhance teaching and learning.

Learning Outcomes

The participant should be able to:

1. Demonstrate the application of knowledge and skills of digital literacy in the learning process of primary science
2. Create digital literacy materials for the learning process
3. Plan for teaching by analysing curriculum designs and textbook to identify effective learning tasks
4. Appreciate the importance of digital literacy in the learning process of science

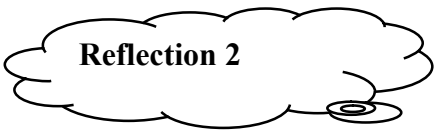
Meaning of digital literacy



Reflection 1
What is the meaning of digital literacy?

You may have come up with..

- use of computers, tablets, phones
- Applying the knowledge of computers in daily work
- Awareness of the ability to use computers
- ability to engage with technology effectively when sourcing, creating, evaluating and using the technology in the learning process



Reflection 2
i) Identify the digital devices that have been in existence since the 20th century. ii)Arrange them from earliest to the latest

You may have listed some of the following:
Camera, Radio, Gramophone, Radio cassette, TV, and computer

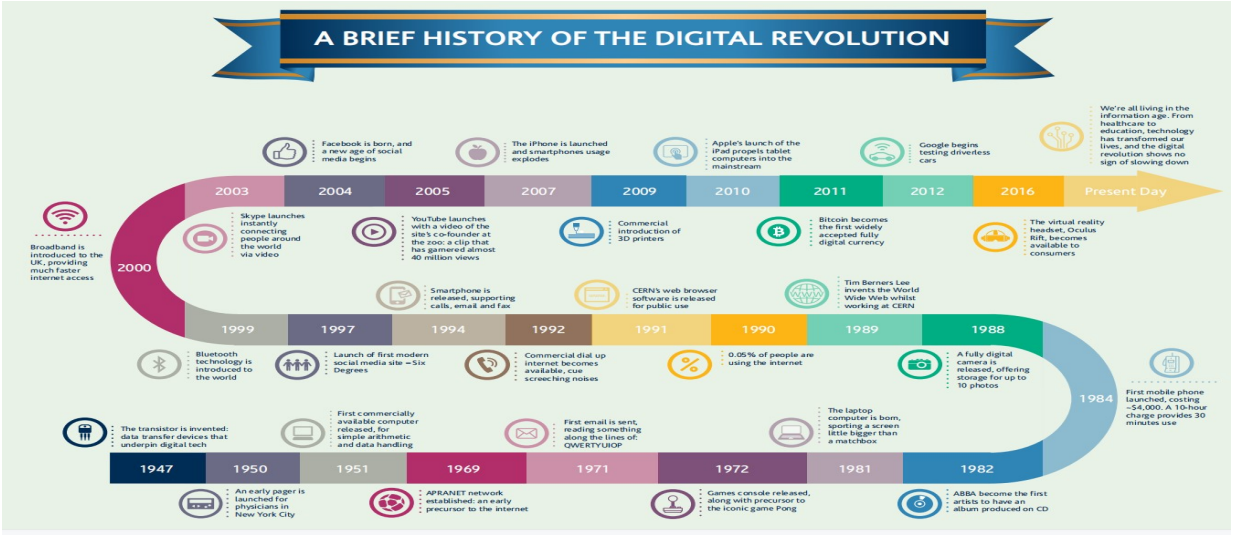
Think, Pair and Share

Discussion: How has the digital world been evolving?

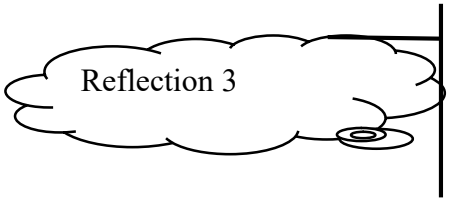
You may have come with the following

Aspect	From	To
Size	Physically Large	Small in size
Speed	Slow in processing	Fast in processing data
Storage Capacity	Small	Large
Design	Clumsy and Ugly	Ergonomic
Versatility	One task	Multi - Task

Summary of the digital revolution since 1947



Source: https://stfc.ukri.org/files/digital-revolution-infographic/



Reflection 3
What are some of the Indicators of digital literacy?

What are some of the Indicators of digital literacy?

You may have come up with the following. A learner with digital literacy skills is able to;

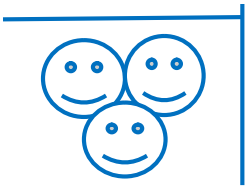
- Use digital device communication networks,
- Engage in online communication and social networks,
- Being aware of and adhering to ethical behaviour protocols,
- Being aware of societal issues raised through digital media,
- Search, evaluate and use information channelled through digital platforms,
- Safely and securely use technology.

Identification, creation, and use of ICT resource materials

There are numerous digital resources for teaching and learning. It is therefore critical for teachers to know which of these resources they can effectively use .There are several tools that can be used in the learning process of science. These tools include: Smart mobile phones, laptops, desktop computers, tablets/ iPads, internet, digital content – E-books (KICD content), digital cameras.

In addition there are applications such as office suite (word processors, spreadsheets, presentations), web based applications (Google Chrome, Mozilla, Internet explorer, opera mini), online conferencing applications(Zoom, Google Meet, Microsoft Teams) among others to enable the functionality of the digital devices.

Discussion



Discussion 1a

List down various digital devices and their use in the learning process of science (use the chat features in the platform)

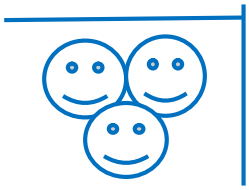
You may have come up with the following;

Device	Application
Digital Camera	Take digital photos and video
Smart mobile phone	Take digital photos and video, scan documents, download

	resources, record, communicate, store documents, edit documents

Digital devices are used in creating digital resources that can be used in demystifying concepts in the learning process. Digital resources could be photos, video clips, animations and simulations.

Discussion



Discussion 1b

Use your phone to create digital teaching learning resource in your learning area

Reflection: Where am I in terms of digital literacy development?
The table 1 shows the various stages of digital literacy development. Analyze the description of each stage and select the stage to which you think you are by now.

Table 1: Stages of digital literacy development

Digital literacy stage	**Emerging Level 1**	**Applying Level 2**	**Infusing Level 3**	**Transforming Level 4**
Description	I am able to use a digital device but at the basic level	I am able to make general and specific use of digital devices I am able teach with specific digital tools and software such as drawing, designing, modeling and application specific tools	I am able to make Dynamic and complex use of digital tools	I am able to experiment and innovate with digital devices ICT has become an integral though invisible part of my daily personal productivity and professional practice
My level of digital literacy development (Tick appropriately)				

Activity 1

Activity 1: Describe how you would use the digital Teaching/learning resource you made in activity 1b) to teach a concept in your subject area. Explain how the digital resource enhances understanding of the identified concept. In explaining on how digital resource enhances understanding of the identified concept, consider the examples given in the table 2

Table 2: Illustration of use of a digital teaching/learning resource

Topic	**Objectives**	**Content (concept)**	**Which Technologies to use**	**How the technology enhances understanding of the concept**
Unit: Plants Topic: Growth and reproduction in plants	By the end of this topic, the learner should be able to: describe pollution and fertilization	Pollution, meaning, types and agents	Video https://www.youtube.com/watch?v=aXmfQLC8ju4	Through use of animations, the technology simplifies the meaning, types and agents of pollution
Unit: Fraction Topic: Addition and subtraction of Fraction	By the end of this topic, the learner should be able to: add and subtract two fraction using LCM	Equivalent fractions	Videoclip; https://www.youtube.com/watch?v=QnE9CyOkAJM	Facilitator to explain through the video why when are converting proper fraction into improper fraction we undertake the following steps: a) multiply denominator by the whole number, b) add the product to the numerator, and c) the sum is the numerator divided by the original denominator

UNIT Two (a): Digital Literacy for Teaching and Learning of Geometry

Introduction

Welcome to section two of unit two in Mathematics. The Strand Geometry will be used to demonstrate digital literacy. The section is divided into two parts which include preliminaries and learner activities in Geometry using digital resources. The preliminaries include the introduction, rationale, and learning outcomes. In part two, non-digital and digital activities are used to show how they can be used in a lesson for the learning process. You will be provided with an opportunity to share your experiences in the facilitation of learning of Geometry and use of digital and non-digital resources in Geometry

Rationale

Digital literacy is one of the seven core competencies in Competency Based Curriculum and cuts across all levels of education. It helps in concretizing abstract concepts through illustrations, animations, and simulations; among others therefore enhancing learner's understanding of difficult concepts. The Report on Analysis of Training Needs of Mathematics Lecturers and Teacher Trainees in Diploma Teacher Colleges (CEMASTEA, 2021) identified Geometry as one of the difficult strands for both lecturers and teacher trainees. The reasons cited for Geometry being a difficult strand included; lack of activities or practical work for teaching, lack of interest, and the strand being difficult to understand.

Digital literacy can provide opportunities for learner interaction through activities and this will demystify concepts, create interest in learners and enhance their understanding of the concepts. In Geometry, it can help learners to develop skills of visualization, critical thinking, intuition, perspective, and problem solving. It is useful to consider geometry as a practical subject that provides opportunities for pupils to use a range of resources to explore and investigate properties of shapes and geometrical facts as contained in the curriculum designs. Geometry should be presented in a way that stimulates curiosity and encourages exploration that enhance learners' understanding and hence change their attitude towards mathematics. In this section, you will have an opportunity to discuss and develop digital resources that can be used to enhance learning process of Geometry.

Learning outcomes

1) Enhance knowledge and skills in using digital tools for facilitation of learning Geometry
2) Source and use digital resources for facilitation of learning Geometry
3) Appreciate use of digital resources for facilitation of learning Geometry

Digital learning resources

Digital Learning Resources refers to digital resources such as applications, software, programs, or websites that engage learners in learning activities and support learners' understanding. The digital resources should provide learning experiences that allow learners to actively explore and construct mathematical ideas; provide activities that stimulate curiosity and interest; and tasks that challenge learners to reason and think deeply about mathematical ideas. The teaching and learning activities should provide opportunities to work with others in a variety of groupings (pairs, small groups, large

group), opportunities to discuss mathematical ideas, clear expectations of what is acceptable social behaviour and learning activities that involve all learners regardless of ability. Digital learning resources save time and provide high level of accuracy.

Reflection

Share your experiences in the facilitation of learning in Geometry
What digital resources would you use to enhance learning in Geometry?

Sum of angles in a triangle

Activity 1 ***(synchronous)***

Design activities for learners, both digital and non-digital to investigate the sum of interior angles of a triangle

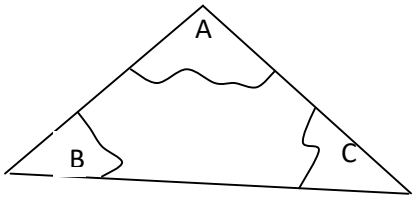
You may have considered the some of the following activities

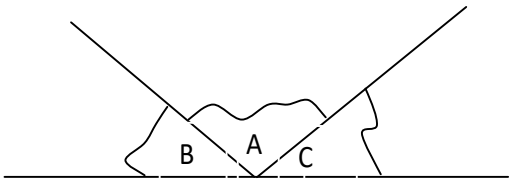
1) **Measuring the angles of a triangle**
   - ✓ Draw different triangles on a sheet of paper.
   - ✓ Measure the angles in each triangle using a protractor and get their sums
   - ✓ What can you say about the sum of angles of a triangle?

NB: the sum should be 180^0 but the results depend on the accuracy of the use of a protractor

2) **Cutting out and arranging the angles of a triangle**

Draw a triangle of any shape. Label the angles as A, B and C. Cut off the angles of the triangles and then fit them together side by side so that the vertices meet at a point as shown below.





Learners to respond the questions below

i) What do you notice?
ii) What does this tell you about the angles of a triangle?

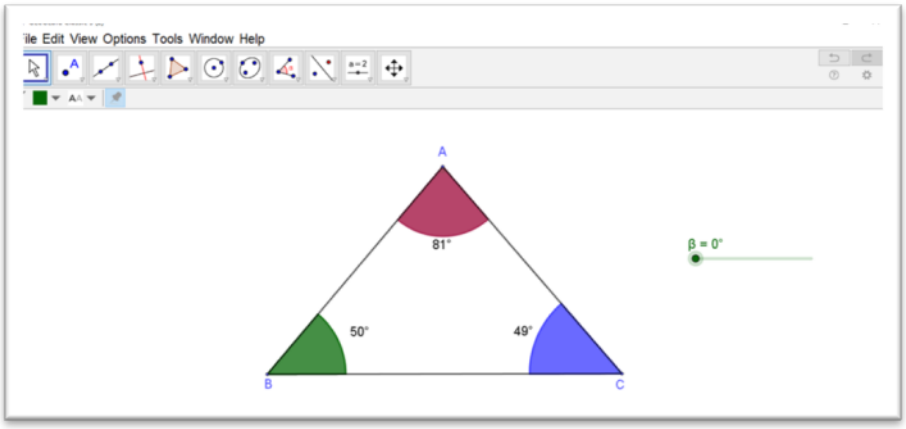
Expected responses

i) A°+B°+C° make a straight line
ii) A°+B°+C°= 180°

3) **Use of digital resources**

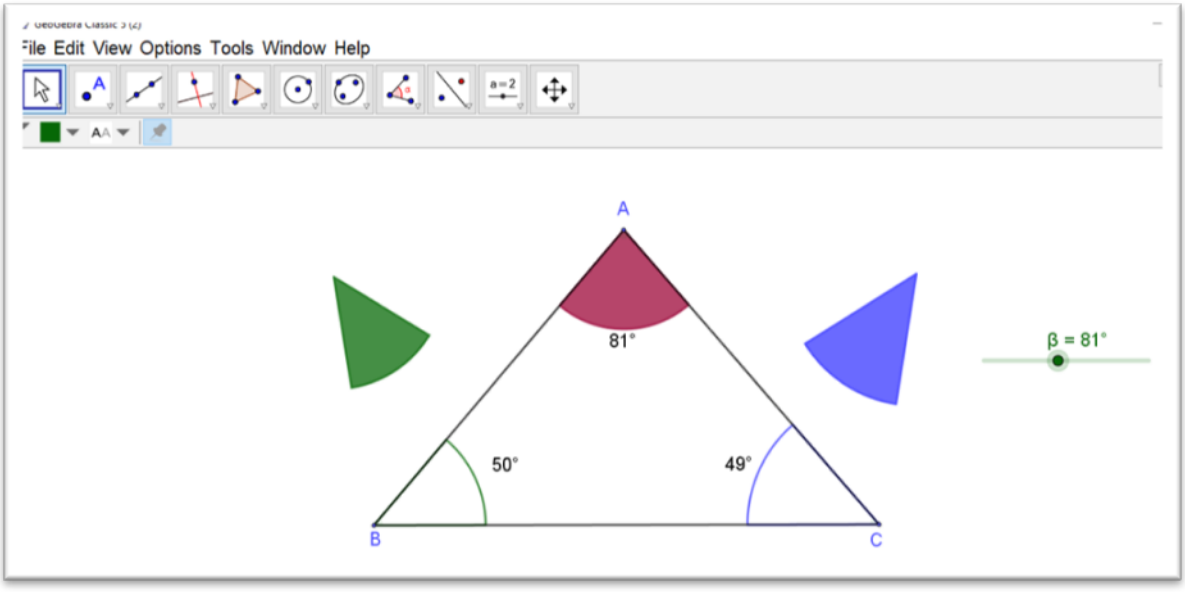
The concept of the sum of interior angles of a triangle can be demonstrated using Geo-gebra software, using a resource sourced from the internet, among others. Below is a demonstration using Geo-gebra

Angle sum in a triangle

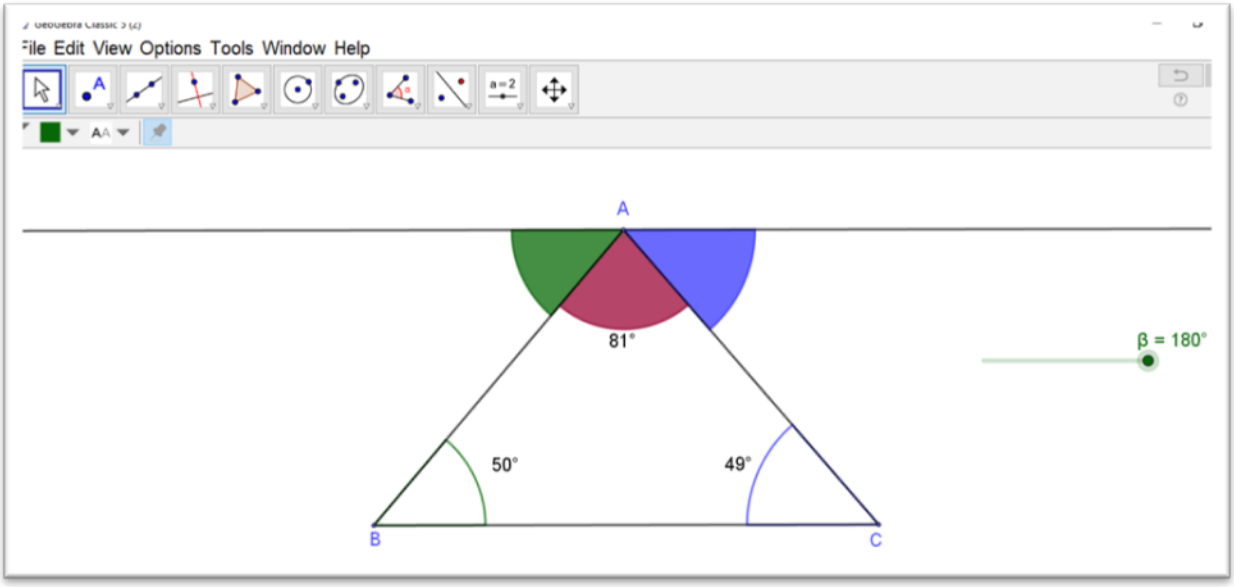


The above triangle ABC can be used to investigate the sum of interior angles of a triangle. The size of the triangle in the digital resource can be changed by moving any of the vertices to show different angles.

Move the slider β until you reach 180˚. What do you observe?



From the diagram below, the three angles form a straight angle (180^0). It can therefore be concluded that the sum of the interior angles of a triangle is 180^0 (straight angle).



Activity 1 (asynchronous)

Design or source digital and non-digital activities for learners to investigate angle sum of interior angles of a quadrilateral

Angles on a Transversal

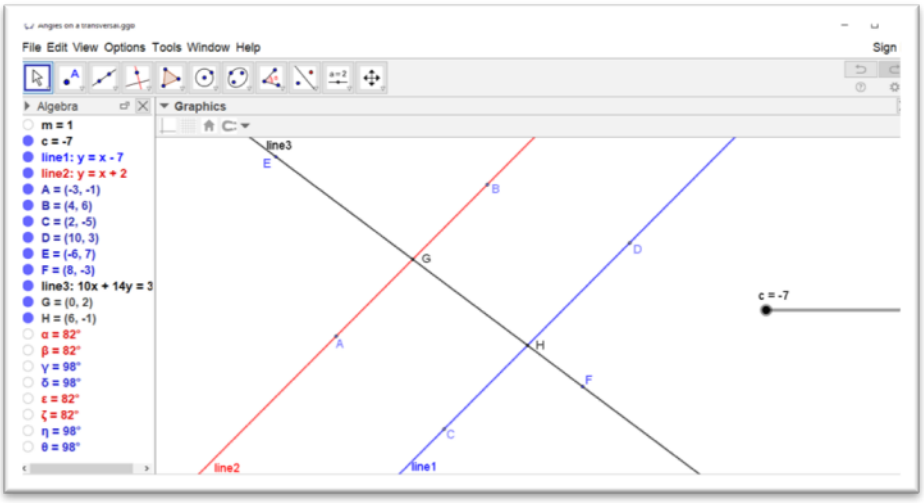
Activity 2 *(synchronous)*

i) How do you introduce the concept of angles on a transversal to your learners?

ii) What activities, both digital and non-digital would you use to investigate properties of angles on a transversal?

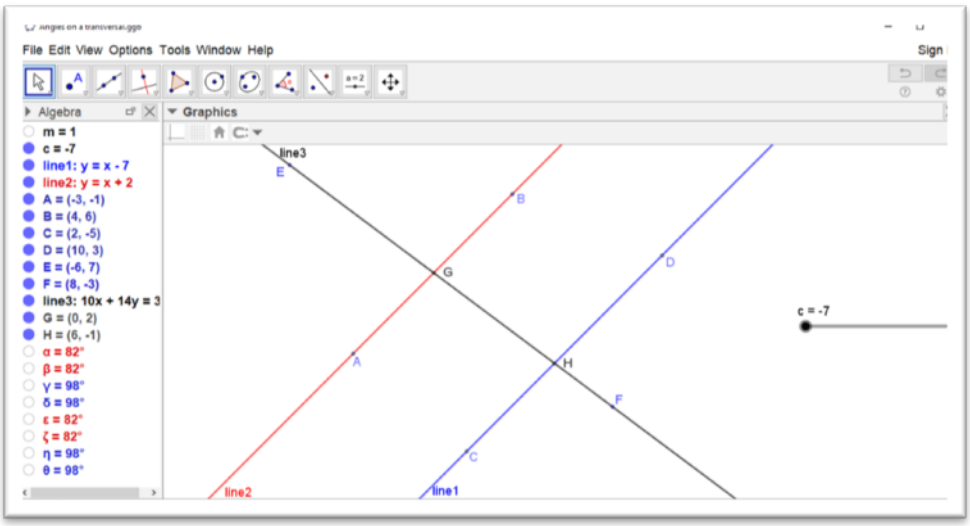
You may use Geo-gebra software to investigate the properties of angles on a transversal as shown below

1) Observe line1 and line 2 in the digital resource provided.
    a. What do you notice?
    b. What are parallel lines?
2) Move the slider for different values of c. What conclusions do you make?
3) What do you call line 3?

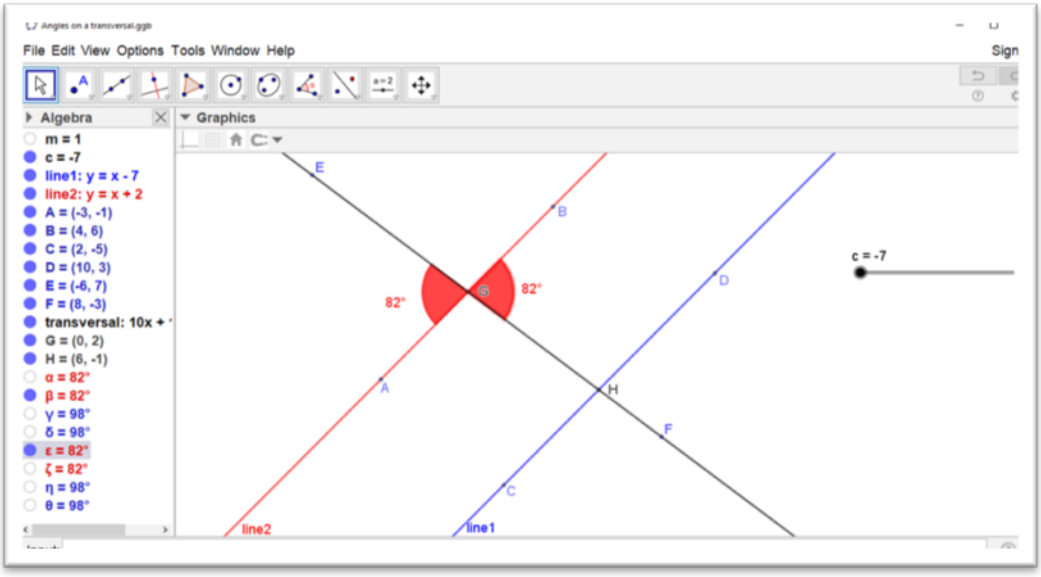


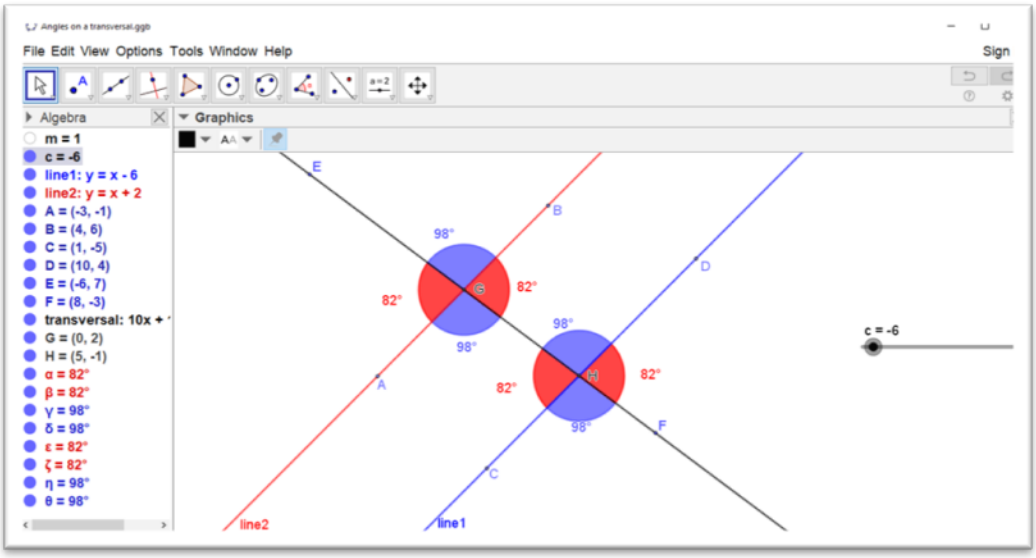
Vertically opposite angles

iii) Identify vertically opposite angles in the digital resource provided below.



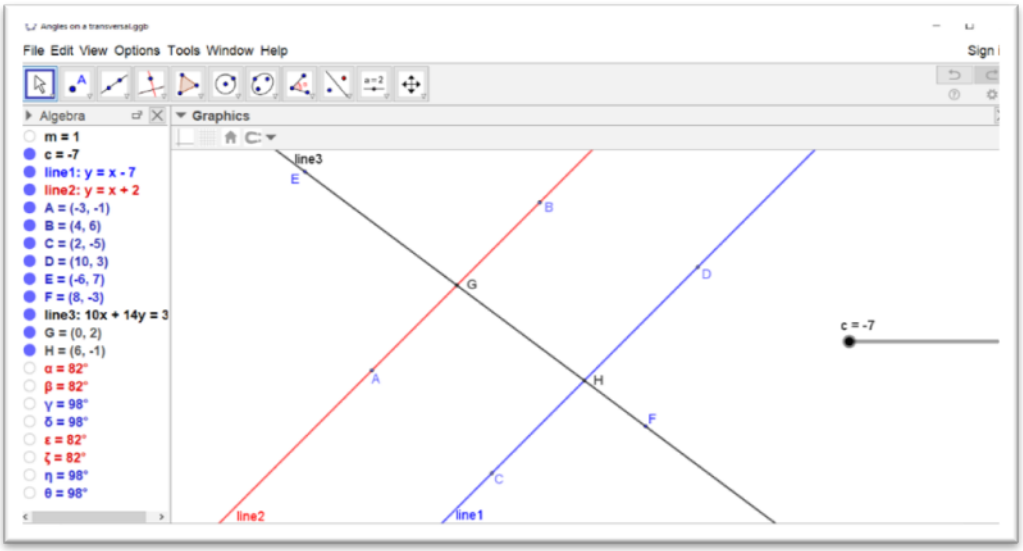
iv) What can you say about vertically opposite angles?



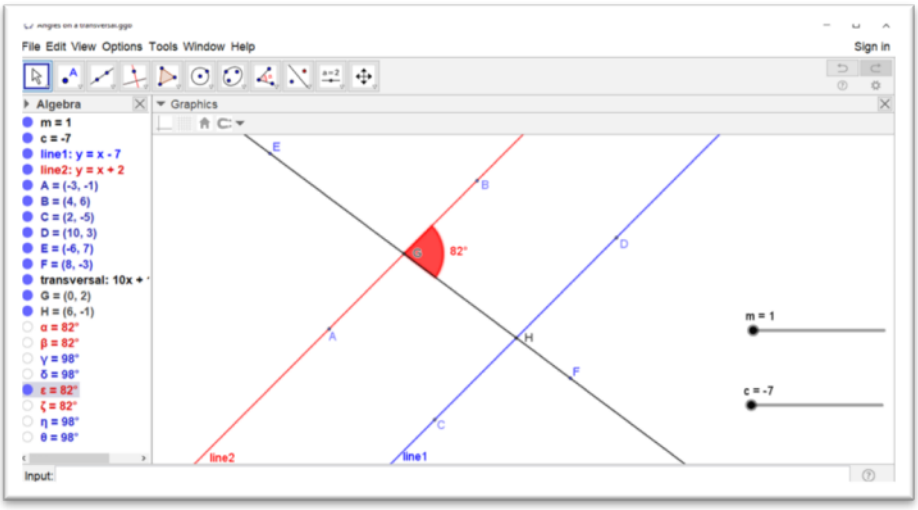


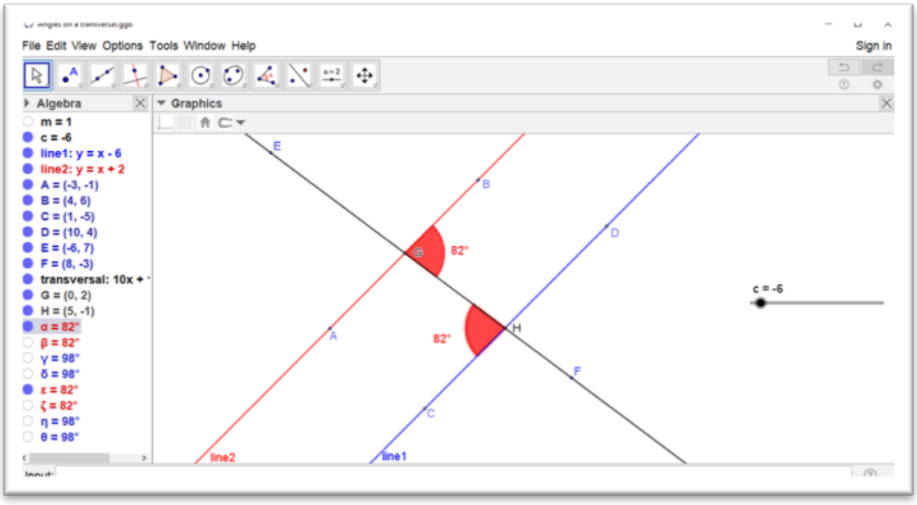
v) Alternate angles

What angle is alternate to angle BGH? Identify all the other alternate angles in the diagram below

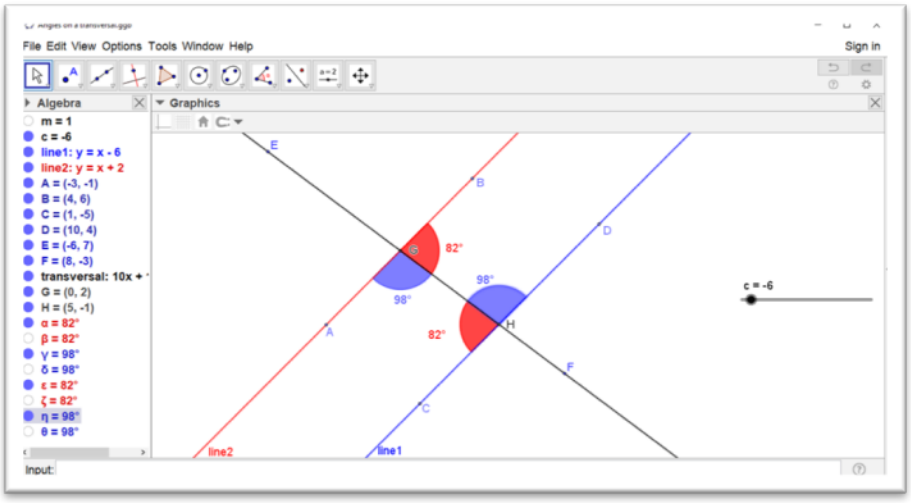


You may have identified the following alternate angles



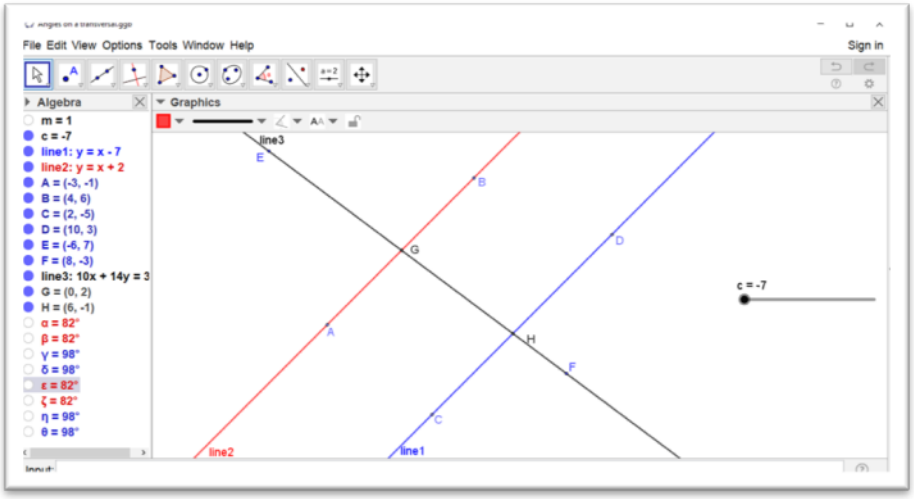


i. Move slider c of the digital resource until the two parallel lines are superimposed
ii. What do you observe?

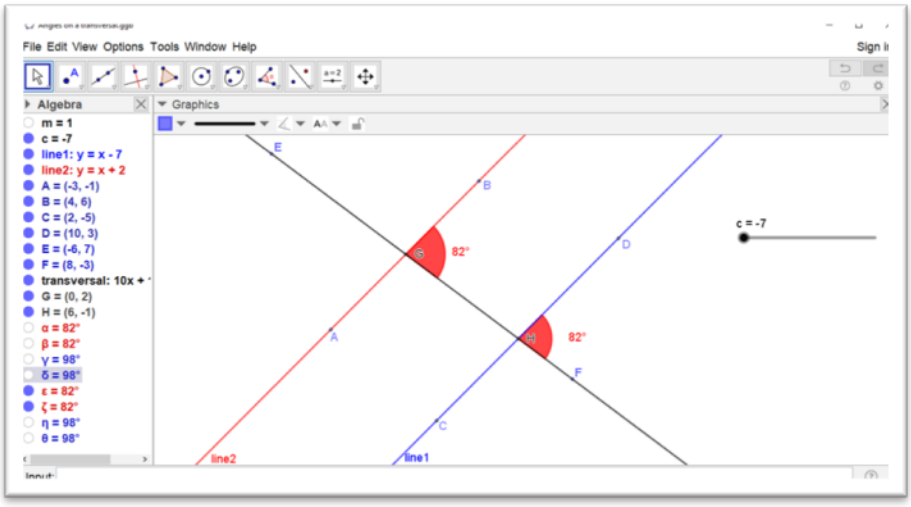


vi) Corresponding angles

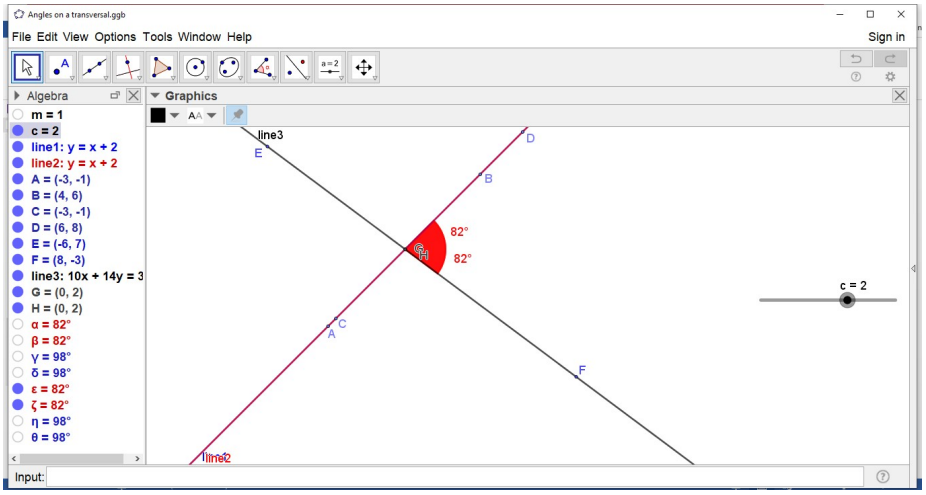
Identify all corresponding angles in the diagram below. What can you say about corresponding angles?



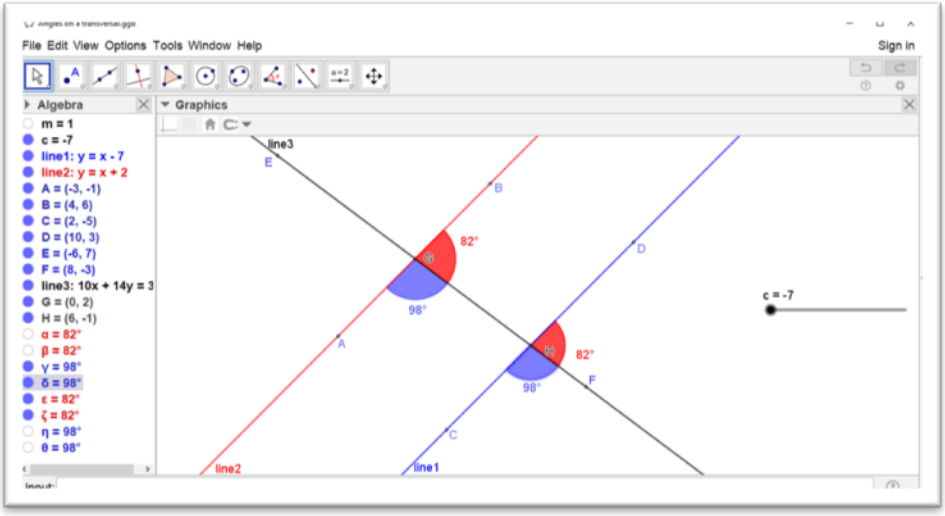
You may have identified some of the corresponding angles as shown below



Let us do some investigation on the alternate angles by moving the slider (slider c) in the digital resource. What do you notice?



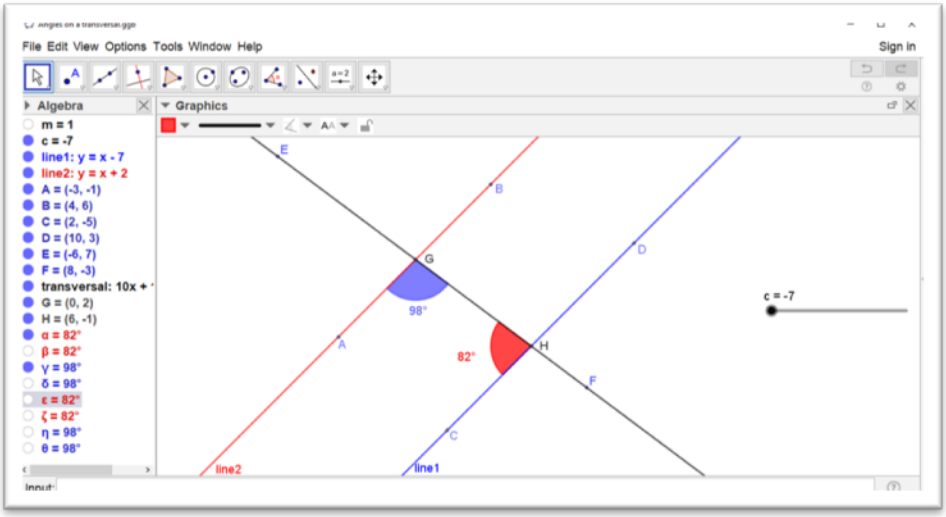
Let us do some investigation on the corresponding angles by moving the slider (slider c) in the digital resource. What do you notice?



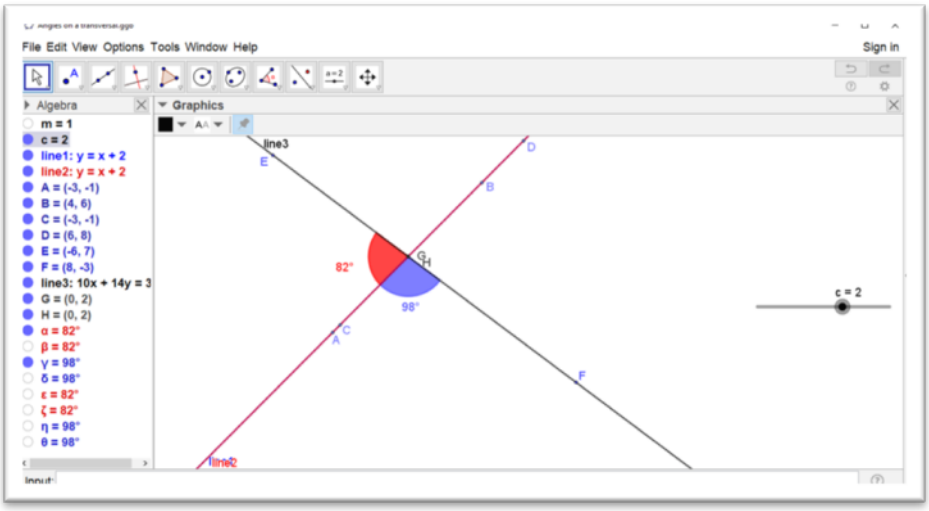
vii) Co-interior angles

a) What can you say of angle AGF and angle CHE?

b) Investigate angle AGF and angle CHE by moving slider c. What do you observe?

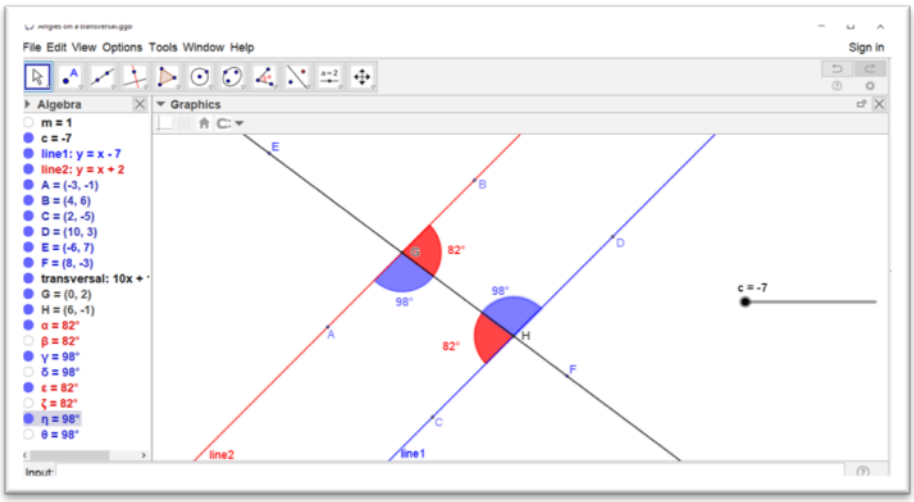


You may have obtained the following



c) Identify other co-interior angles in the digital resource.

You may have identified the following



Application of Geometry in Real life (Asynchronous)

Activity 2 (asynchronous)

i) Design or source a digital resource for use in the learning of a concept in Geometry

ii) Identify how Geometry has been applied in your environment.

Lesson planning

During lesson planning you are expected to analyse the teaching and learning materials commonly used for teaching the concepts. The study of materials for teaching helps you to gain insight into the appropriateness of the suggested activities in helping the learner to understand the concept. The review also is done to evaluate the extent they help the learner to understand the concept. Doing so provides opportunities for you to enhance your pedagogical content knowledge.

Some of the curriculum materials are:

1. Curriculum designs
2. Textbooks

Analysis of Curriculum Designs

Activity 3:

The table 3 illustrates the components of the curriculum designs in the Strand Geometry. From the curriculum design select and fill in the table; one specific learning outcome, one learning experience and key inquiry question and analyse their appropriateness in helping learners understand the Geometry concepts

Table 3: Example of analysis of curriculum designs analysis in the Strand Geometry

	Learning area	**Strand**	**Sub-strand**	**Specific Learning Outcome/s**	**Suggested Learning Experiences**	**Key Inquiry Question**
Grade 4 Component	Mathematics	Geometry	Angles	Compare angles practically	Learners in purposive pairs or groups to compare angles using a right angle. Learners with manipulation difficulties could use any alternative functional part of the body or assistive technology such as head or mouth pointers or universal cuffs or prosthesis to compare angles. They could also use adapted digital devices such as computers with appropriate software such as Microsoft word and expanded keyboards, key guards, sticky keys and or head operated optical mouse or be	Where can you find angles in the environment?

					physically assisted by peers or teacher aide or teacher to insert and compare angles under their instructions Adjust glare on the screens of the adapted ICT devices appropriately for learners with epilepsy and those who may be experiencing difficulties in vision. (Apply these adaptations in all the subsequent activities that involve writing, drawing, mounting and use of adapted digital devices under this sub strand)	
Example of analysis				This can be covered in one lesson	Learners are involved in the angle comparisons to identify acute, obtuse and reflex angles. Leaners had been involved in development of angle concept sequentially There is use of locally available materials which learners can easily identify	There is need to come up with a relevant KIQ for the learning outcome selected
Activity 1 Response						

Text book Analysis

After identifying the concepts to be taught, it is important for the teacher to study and analyse the subject content from a point of view of teaching and learning process. It is a good idea to review textbooks commonly used to evaluate the extent to which they support understanding and mastery of the concepts in the topic. This is a form of study of pedagogical content knowledge which helps to

teach in a way that students can actively inquire during the learning process. Table 4 gives an example of text book analysis in Mathematics.

Table 4: Example of text book analysis in the strand Geometry

Text book **(NB: give the title and publisher)**	**Suggested teaching and learning activities / task** **in the textbook**	**Evaluate appropriateness of the activities in helping learners understanding of the concept**	**Suggest improvements to these activities to ensure they help the learner understand the concept**
Textbook 1: Visionary Mathematics: Grade 4 Learner's Book. KLB (2019)	The activities include: 1. Identifying an angle 2. Angles in the environment 3. Types of angles 4. Forming right angles through paper folding 5. Use the right angle to test the corners of different items in the environment 6. Use the right angle to compare and identify acute, obtuse and reflex angles 7. Identify acute, obtuse and reflex angles in the environment	The activities are appropriate as: 1. Learners are involved in development of angle concept; use of readily available resources; Use of KIQ 2. They are learner centred; is open and learners can form different angles 3. Learners are involved in forming the right angle, testing the corners and identifying acute, obtuse and reflex angles	The suggested improvement on activities for specific learning outcomes are proposed as shown below: ***Angles in the environment*** 1) Group activity 2 can be improved by asking learners to explore other ways of forming angles 2) Learners need to be given an opportunity to identity different types of angles in the environment
Textbook 2			

Textbook 2 Let's Do Mathematics: Grade 4 Learners' Book; Oxford University Press (2019)	1. Forming a right angle, an acute angle, and obtuse angle by folding given pieces of paper along the indicated dotted lines in groups of two. 2. Comparing the resulting angles with the right angle identifying the different types of angles formed using the learners' open fingers in groups. 3. Identifying the different types of angles in the environment 4. Cutting out acute, obtuse, and right angle from marked out circular pieces of paper to form a reflex angle from the remaining piece of paper 5. Applying the knowledge of the types of angles found in real life. 6. Playing digital games on identifying angles	The activities are in line with the intended curriculum relating to real life scenarios. The concept of comparing angles practically is well built from folding pieces of paper to form the acute, right, and obtuse angles. Cutting out acute, right, and obtuse angles from circular pieces of paper progressively guides to illustrate the formation of reflex angles from the remaining pieces. The activity on cutting out the circular pieces of paper (referred to in 4) is appropriate but the instructions can be improved to clearly indicate the parts that remain after cutting. The design of the task in the suggested teaching and learning activities (refer to column 2, number	The activity on cutting out the circular pieces of paper (referred to in 4) can be improved by shading the parts bearing the acute, right and obtuse angles to be cut out. Task number 4 could be redesigned to allow the learners to use all the pieces and discover the reflex angle.

		4) limits the learners in regard to inquiry based learning	

Activity 4: (Fill in the template provided below)
Select any two textbooks you normally use to teach Mathematics and carryout the following;

a) Identify the activities suggested to teach the concept, in each textbook.
b) Evaluate appropriateness of the activities in helping learners understand the concept (describe their strengths and potential drawbacks).
c) Suggest improvements to the activities/ tasks and summarise your findings in table 5

Table 5: Text book analysis

Text book **(NB: give the title and publisher)**	**Suggested teaching and learning activities / task** **in the textbook**	**Evaluate appropriateness of the activities in helping learners understanding of the concept**	**Suggested improvements to these activities to ensure they help the learner understand the concept**

Analysis of curriculum materials helps teachers to select learning tasks. The tasks may not necessarily be drawn from textbooks. Teachers may initiate the tasks from their own creativity and resources guided by the curriculum and their pedagogical vision of learning. The tasks should be: appropriate and valuable in terms of the aims of the lesson; interest the students; of appropriate level of difficulty and can be solved in several ways.

After identifying tasks, you will develop teaching- learning strategies that will be used for achieving the expected learning outcome. Some of the teaching strategies that could be used to promote learners critical thinking and problem-Solving skills includes; use of key inquiry questions, questioning techniques, use of predict, observe and explain (POE), ICT integration and teaching through problem solving among others.

Activity 5:

A sample lesson plan has been provided. Study the sample lesson plan to:

i) Suggest improvement in terms of the core competences, values and PCIs that can be developed and modelled from the tasks given. You may suggest additional tasks to help achieve the specific learning outcomes

ii) Suggest how the identified core competencies, values and PCIs can be assessed

Sample Lesson

Name of school	Grade	Learning Area	Date	Time	Roll
CEMASTEA	6	Mathematics			

Strand: Geometry

Sub-strand: Angles

Specific Learning Outcomes: By the end of the lesson, the learner should be able to:

(i) Determine the sum of angles in a triangle

(ii) Establish the sum of angles in a triangle

(iii) Appreciate the sum of angles in a triangle

Key Inquiry Question

How do we determine the sum of angles in a triangle?

Learning Resources

Cut outs, Geometrical set, 30cm rulers, Learner's digital devices (LDD), Laptop/desktop

Organization of learning

The lesson will be held indoors. Learners will work in groups and then share their work with others.

Introduction

Learners in pairs identify types of angles (right angles, acute angles, obtuse angles and straight angles) from provided cut outs.

Lesson presentation

Step1: Learners in pairs to draw a triangle. Learners discuss how they can establish the sum of angles in the triangle. Learners to explore different methods of establishing the sum of angles in the triangle

Core competence

1. *The core competence of 'critical thinking and problem solving & 'Learning to learn' will be developed as learners explore and use different methods of establishing the sum of angles in the triangle.*
2. *The core competence of digital literacy will be developed as learners use LDD*
3. *The core competence of 'Learning to learn' will be developed as learners measure and confirm the sum of angles in a triangle*

Values

1. Respect as learners work together
2. Honesty and unity as learners share and take turns in using the instruments

PCIs

Social cohesion as learners works in groups

Safety as learners handles different instruments

Step 2: Learners present their methods of establishing the sum of angles in a triangle. The teacher to guide the presentations and probe further for all methods to be covered

Method 1: Measuring the angles and getting the sum

Method 2: Cut out the angles and arrange them to form a straight angle

Method 3: Establishing the sum of angles in a triangle digitally on the LDD.

The core competence of self-efficacy & communication and collaboration will be developed as learners present their methods

Values

During presentations learners have will have an opportunity to model respect and unity

Conclusion

Teacher to summarise on how to determine the angle sum of a triangle

Extended learning

Learners to work out the angle sum of triangular objects found at home or the environment

Lesson reflection: The teacher reflects on learner's achievements, challenges and suggests the way forward

Activity 6: Identify a specific learning outcome in the strand Geometry; design a lesson plan with tasks that would promote inquiry in learners. Suggest the core competence(s) to be promoted, values to be modelled and how they will be assessed.

Upload your lesson plan in the google classroom

UNIT TWO (b): Digital Technology: Coding

Introduction

You have been introduced to digital devices and applications. The applications are developed using coded instructions for their functionality. These codes are a series of logical steps to accomplish a task. In this session, you will discuss coded patterns to help understand the meaning of coding and plan for teaching the concept.

Learning Outcomes

By the end of this section, you should be able to:

i) Identify coding for effective facilitation of learning
ii) Generate coded patterns of objects in the environment
iii) Plan for teaching the concept coding
iv) Appreciate the importance of coding in daily life

Content

In our daily lives we consciously or unconsciously follow a logical pattern of steps to accomplish our chores. There are a number of instances where a set of instructions, verbal or nonverbal are used to produce a desired outcome. Some of these cases may be natural or man-made. A learner has a pair of shoes and socks in the morning and is required to list down the steps they would follow to dress up before going to school. This requires the learner to follow steps in logical to achieve the desired outcome, which in this case is going to school.

Outline the steps this learner would take to prepare for school;

1.

2.

3.

You may have come up with the following;

1. Put on the socks
2. Put on the shoes
3. Tie shoe laces (optional only available if the shoes have laces)

4. Go to school

It would not make sense if the order in which these steps are listed is altered. You can alter the sequence and see whether it makes sense!

Figure 1: A bottle of water

Discussion 1

a) Highlight the steps you would follow to drink the bottled water shown in the figure 1.

b) Give examples on real life situations that require logical steps to obtain desired outcomes e.g. steps in making a cup of tea.

c) Highlight the steps one would need to follow to get the desired outcome in (b) above.

You may have come with the following

Step 1: Hold the bottle
Step 2: Remove the seal
Step 3: Open the cap in anti-clockwise manner
Step 4: Lift the bottle
Step 5: Position the open end of the bottle in the mouth
Step 6: Tilt the bottle
Step 7: drink the water

Discussion 2

How can you use these activities that you identified under reflection as well as in activity 1 and 2 to introduce the concept of coding?

Expected responses

1. *Let learners in small groups (or as a whole class discussion) come up with examples of activities they do that involve a sequence of steps e.g. doing a mathematics exercise in a class, taking lunch during lunch break, guiding a parent to come to grade 5 class from home (or the school gate) etc.*
2. *Learners come up with steps involved in these activities e.g. doing a math's exercise*
   - *i) Remove the exercise book from the bag*
   - *ii) Open the book to the right page to write on*
   - *iii) Take a pen or pencil*
   - *iv) Write the date on the page*
   - *v) Write the question to be done*
   - *vi) Start doing the questions given for the math's exercise.*
3. *Guide learners to realize that these steps are logical, for example a pupil cannot start doing the exercise in the exercise book without first taking a pen or pencil. (However some steps can be skipped). These steps lead to a desired outcome.*
4. *Guide learners to discover that coming up with steps that lead to a desired outcome is coding.*

Further activities

Consider the following letters of the alphabet.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

If we assign each letter a number as shown in table 1, it is possible to use a combination of the numbers to spell a word.

Table 1 assigning numbers to letters of the alphabet

A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**

N	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**
14	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**

EXAMPLE

Table 2 words spelt using numbers

WORD	**NUMBERS(Code)**
CAT	3-1-20
DEVICE	4-5-22-9-3-5
TECHNOLOGY	20-5-3-8-14-15-12-15-7-25

Table 3 words formed using numbers

7-1-18-12	GIRL
2-15-25	BOY
8-15-13-5	HOME

Note: The dashes (-) used here are NOT part of the coding, but are separators.

Activity 1

Using the information above identify which word is represented by this combination of numbers 4-9-7-9-20-1-12 and hence define coding

Discussion 3

Based on the above activities (Reflection, activity 1 & 3) how can we define coding?

Expected responses

What you have done during reflection, activity 1 and 3 are all examples of **coding**.

Coding is a way of arranging numbers, letters, shapes or steps to make a meaning.

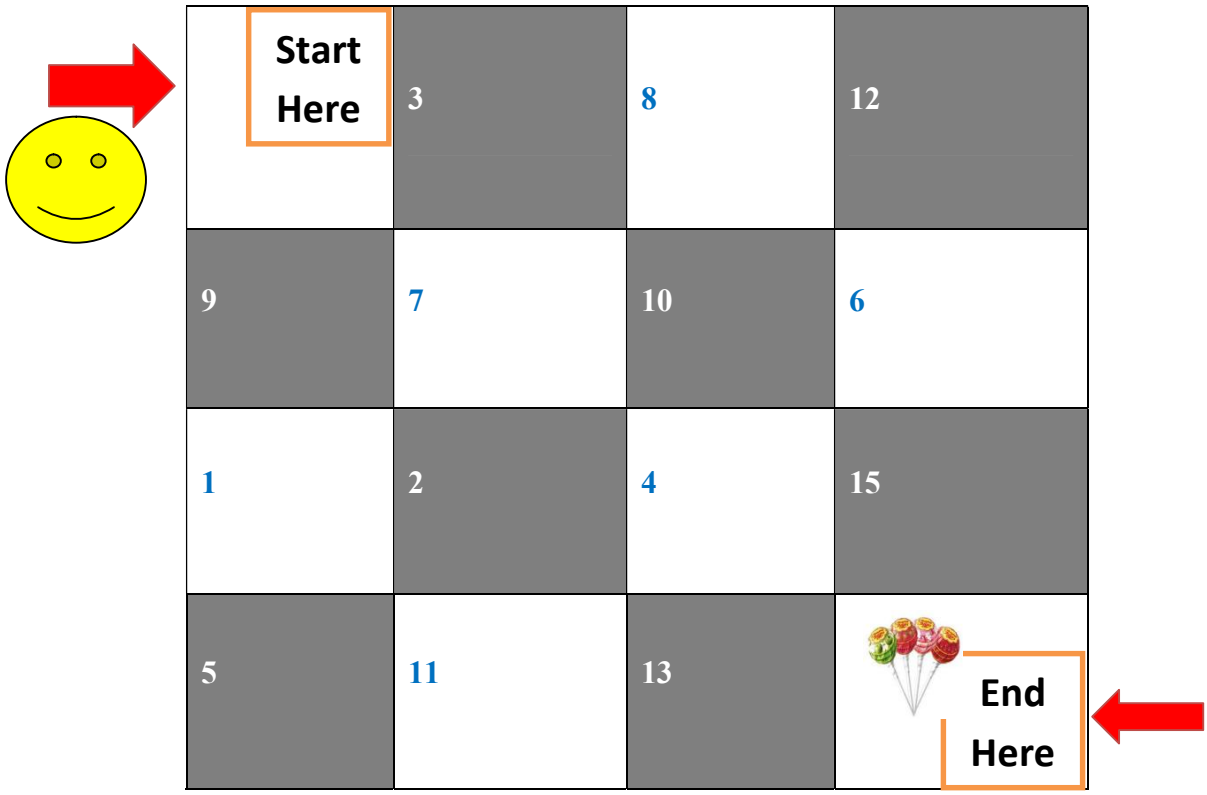
Coding is the process of creating step-by-step instructions to perform a particular task.

A code is a set of such instructions to perform a particular task.

Discussion 4

Tell your friend how to move the smiley face to the last box where the lollipops are.

Note: The smiley face can only move vertically or horizontally!



Expected responses

The smiley face can move in the following order;

Start, Move to 3, then Move to 8, then Move to 12, then Move to 6, then Move to 15 and to the lollipops. This route can be coded as START 3-8-12-6-15- END at Lollipops.

This is a possible route for the code. **Task:** Write three other possible codes for the steps to reach the lollipop!

Reflection

Reflection: *How is this activity relevant in teaching the concept of coding?*

It makes use of a sequence of specific steps to attain a desired outcome or result. The desired outcome in this case is having the smiley face at the lollipop box.

Observing and Identifying Coded Patterns

Activity 2: You are provided with some pictures below:

Identify the patterns and show how you can use these patterns to teach the concept of coding

Banana Leaves

Maize Leaves

Weaver bird

Robin Bird

Swallow Bird

Expected response

i) *Allow learners to make observation of leaves of different plants and/ or nests of different birds*

ii) *Let them write down their observations about patterns in leaves of the same plant and that of nests of the same birds (you should provide at least two leaves of the same plant and two nests of the same birds)*

iii) *With good observation learners will realize that leaves from the same plant have the same patterns, similarly nests of the same bird have the same pattern.*

iv) *They will therefore be able to conclude that these patterns can be used to identify that particular plant or that particular nest.*

v) *The teacher should guide them to establish that any pattern that can uniquely identify an object is a code and that leaves and nests have a natural code*

Discussion 5

Identify the patterns in each ball and Associate the game with ball

A B C **D**

In the previous examples we saw that a code can be formed by letters, for example words formed from letters of the alphabet or by combination of numbers assigned to the letters.

A code may also be coined from numbers, for example the route to the lollipop.

Drag and drop activity

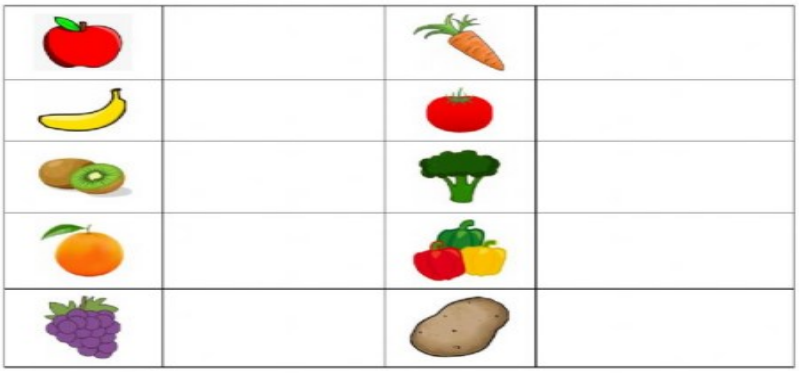
The drag-and-drop tools are easy to use, and demonstrate how computers process coding languages. The learner can visualize how code works and see the results of their work almost instantly. The straight forward nature of these tools makes it easy to create multiple projects and games.

Activity

The table below has a list of fruits and vegetables, cut out the name of the fruit or vegetable and paste it on the chart in the appropriate position to match the fruit or vegetable in the picture.

DRAG AND DROP: FRUIT AND VEGGIES!
READ THE WORDS AND DRAG THEM NEXT TO THE DRAWING.

APPLE	ORANGE	CARROT	PEPPERS	POTATO
KIWI	BANANA	GRAPES	TOMATO	BROCCOLI



With this foundation, youngsters will not only be ready to tackle more and more sophisticated coding projects, they'll have something arguably of equal importance: the drive and curiosity to keep learning.

Lesson planning

During lesson planning you are expected to analyse the teaching and learning materials commonly used for teaching the concepts. The study of materials for teaching helps you to gain insight into the appropriateness of the suggested activities in helping the learner to understand the concept. The review also is done to evaluate the extent they help the learner to understand the concept. Doing so provides opportunities for you to enhance your pedagogical content knowledge. Collaborative lesson planning allows teachers as a community of practice offer peer learning and support.

Some of the curriculum materials are:

3. Curriculum designs
4. Textbooks

Analysis of Curriculum Designs

Activity 1:

The Table 6 illustrates the components of the curriculum designs in the Strand digital technology and sub-strand coding. From the curriculum design select and fill in the table; one specific learning outcome, one learning experience and key inquiry question and analyse their appropriateness in helping learners understand the concept coding

Table 6: Example of curriculum design analysis in the strand Digital technology

	Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Key Inquiry Question	Analysis
Component	Digital Technology	Coding	By the end of the substrand the learner should be able to: a)state meaning of the term 'coding' b)identify coded patterns c)play simple puzzle games	a) In groups, learners are guided to discuss the meaning of the term 'coding' b) In groups, learners are guided to observe, identify and discuss locally available coded patterns (for the example arrangement of leaves, how birds make nests, arrangement of shapes on a football and tennis ball, Sudoku in Mathematics, Word puzzle in English). c) Use digital devices to observe, identify and discuss different coded patterns d) In groups, learners are guided to play simple puzzle games (for example: fitting	What is coding?	• The three specific learning outcomes in this sub-strand can be further split to get 5 learning outcomes, one per lesson with relevant KIQ for each learning outcome or • Some of the specific learning outcomes can be achieved in more than one lesson • Each lesson must have three specific learning outcomes addressing knowledge, skill and attitude • Learning experiences can be arranged in such a way that observing and identifying can be in one lesson while discussion can be for the next lesson • Use locally available

				in missing parts to complete the whole; re-assembling dismantled parts to complete the whole, word puzzles) e) Use digital devices to solve simple patterns (for example: computer games and puzzles)		materials is encouraged
Activity 1 Response						

Text book Analysis

After identifying the concepts to be taught, it is important for the teacher to study and analyse the subject content from a point of view of teaching and learning process. This is a form of study of pedagogical content knowledge which helps to teach in a way that students can actively inquire during the learning process.

Activity 2:

The Table 7 gives an example of text book analysis in Science and Technology. Select two textbooks you normally use to teach science and technology and carry out the following;

a. Identify the activities suggested in the textbook to teach the concept coding
b. Analyse the appropriateness of the activities in helping learners understand the concepts
c. Suggest improvements to the activities and summarize your findings in the table

Table 7: Example of text book analysis in Science and Technology

Text book **(NB: give the title and publisher)**	**Suggested teaching and learning activities / task** **in the textbook**	**Evaluate appropriateness of the activities in helping learners understanding of the concept**	**Suggested improvements to these activities to ensure they help the learner understand the concept**

Textbook 1: Know More Science and Technology Grade 4 Story Moja (2019)	1. Discuss the meaning of coding: • *Talk with your friend about the meaning of coding* • *Write down the meaning of coding in your exercise book* • *Talk with your teacher about the meaning of coding*	The activity introduces the term code abruptly limiting critical thinking in learners.	***Bring out an activity in real life that will give an idea about coding e.g signs used by traffic police or signs teacher uses in class to indicate silence***
Textbook 2 Master Science and Technology: Grade 4 Learners' Book; Booklyst Press Limited (2019)	Group activity: Learners are given a table with codes and meanings and asked to talk about them	The book should have started with symbols in place of codes	The activity is good however; replace the word code with symbols. Teachers can use other symbols with local meaning

Analysis of curriculum materials helps teachers to select learning tasks. The tasks may not necessarily be drawn from textbooks. Teachers may initiate the tasks from their own creativity and resources guided by the curriculum and their pedagogical vision of learning. The tasks should be: appropriate and valuable in terms of the aims of the lesson; interest the students; of appropriate level of difficulty and can be solved in several ways.

After identifying tasks, you will develop teaching- learning strategies that will be used for achieving the expected learning outcome. Some of the teaching strategies that could be used to promote learners critical thinking and problem solving skills includes; use of key inquiry questions, Questioning

techniques, use of predict, observe and explain (POE), ICT integration and teaching through problem solving among others.

Activity 3:

A sample lesson plan has been provided. Study the sample lesson plan to:

iii) Suggest improvement in terms of the core competences, values and PCIs that can be developed and modelled from the tasks given. You may suggest additional tasks to help achieve the specific learning outcomes

iv) Suggest how the identified core competencies, values and PCIs can be assessed

Sample Lesson

Name of school	Grade	Learning Area	Date	Time	Roll
CEMASTEA	4	Science and Technology			

Strand: Digital Technology

Sub-strand: Coding

Specific Learning Outcomes: By the end of the lesson, the learner should be able to:

(i) Explain coded patterns in locally available material

(ii) Observe coded patterns in locally available material

(iii) Appreciate the importance of coded patterns in locally available material

Key Inquiry Question

What is a coded pattern?

Learning Resources

Exercise books, **s**hirts, blouses, football

Organization of learning

The lesson will be indoors. Learners will work in groups and then share their work with others in class.

Introduction

The teacher introduces the lesson by reviewing the meaning of coding by asking learners in pairs to code some words using the key given below

Use the numbers to code some word, for example (i) CAT (ii) COMPUTER

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
14	15	16	17	18	19	20	21	22	23	24	25	26

(Cards cut in shapes to fit number and letter patterns can be used)

The activity will help the teacher to assess learners' prior knowledge on the meaning of coding and link with the current lesson on coded patterns.

Lesson presentation

Step1: Learners are provided with the following locally available materials and in groups, are guided to interact and identify patterns. In groups learners are guided to observe, identify and discuss locally available coded patterns (for example arrangement of leaves, how birds make nests, arrangement of shapes on a football ball and netball,

a) Exercise books,

b) Shirts,

c) Blouses,

d) Football

***1st Suggestion**: The core competence of 'critical thinking and problem solving will be developed as they interact and identify patterns in locally available materials*

***NB:** You can assess this core competence of critical thinking and problem solving using an observation schedule with indicators such as 'seeks clarification from peers and the teacher on*

appropriate methods of identifying patterns; analyse and evaluate the suitability of alternative approaches of identifying patterns in locally available materials.

Step 2: Learners present their findings to each other (learners are encouraged to critic/question the findings of each other).

2nd Suggestion: *The core competence of communication and collaboration will be developed as the learner works with others in identifying patterns and present their work*

NB: You can assess this core competence of communication and collaboration using a checklist with indicators such whether a learner is able to 'listen; ask questions; pay attention; critique; speak clearly; share information with others and appreciate efforts of others when identifying and observing patterns in locally available materials.

3rd suggestion*: To look for opportunities to help the learners to model respect and unity as they work together identifying patterns and as they critique each other's' work during presentation*

4th suggestion: *The values of respect and unity enhances the PCI on* ***'life skills, values and human sexuality'*** *in regard to the learner knowing on how to live with others (empathy, assertiveness, friendship formation*

NB*: You can assess the values of respect and unity using a checklist with indicators such whether a learner is able to: display humility; is patient; accommodate diverse opinions and understand and appreciate others when identifying or observing patterns in locally available materials.*

Conclusion

Teacher to summarize by emphasizing the importance of patterns in coding

Extended learning

Extended learning: With the help of parents and care givers learners to identify patterns from objects found at home or the environment

Lesson reflection: Teacher reflects on learners' achievements, challenges and suggests the way forward

Activity 4: Identify a specific learning outcome in the substrand coding; design a lesson plan with tasks that would promote inquiry in learners. Suggest the core competence(s) to be promoted, values to be modelled and how they will be assessed.

Upload your lesson plan in the google classroom

Conclusion

In this section, we were able to build our pedagogical content knowledge for effective implementation of CBC through analysis of the curriculum designs and text books and eventually planning for teaching the concept coding. The meaning of coding as a set of instructions that lead to the desired outcome was demonstrated by observing natural and man-made patterns of things such as leaves, nests etc. These patterns uniquely identify the object so that the ones with the same pattern belong to a specific group e.g. maize leaves have the similar pattern and weaver bird nests have also similar patterns. These patterns are examples of codes. Coding is used to generate instructions for digital devices to work. A digital device such as a computer produces words and letters based on codes. Coding is therefore an important skill in the 21st century where there is increased use of digital devices.

You are expected to transfer the knowledge and skills learnt as you implement the curriculum in all learning areas

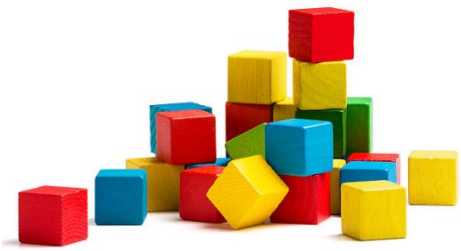
Extended Learning Activities

Learning to code for the first time can be intimidating, especially for young learners. But if a child has never coded before, block-based coding offers a simple, visually-engaging introduction that balances fun with showing kids important fundamentals of programming.

Activity

Learners are given real blocks and they are asked to make patterns in pairs or groups.

This is programming at lower level



Activity

They repeat activity 2-arranging the blocks to make a pattern, but with their ICT devices

Activity

Create animations

By the end of the sub strand, the learner should be able to;

Create simple games and graphics for enjoyment

In groups, learners use online video tutorials to find out how to create simple games and discover how to create their own graphics

Programming languages provide the rules to build websites, apps and other computer based technologies.

Learner use graphics and easy-to-follow instructions to build computer projects using Scratch, a free programming language

Learner to build single and multiplayer platform games, create puzzles and memory games, race through mazes, add animation.

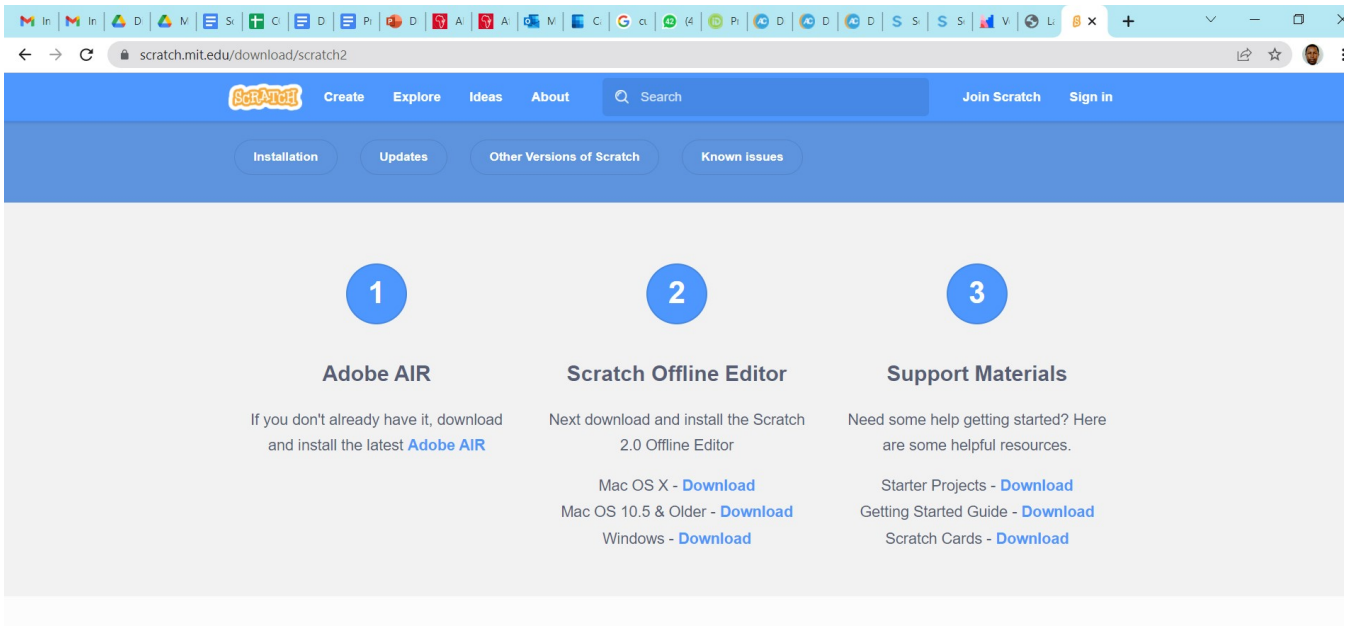
SCRATCH Computer programming supports initiatives by teaching students how to think creatively, work collaboratively, and reason systematically.

You can download and install Scratch platform in the digital devices. Learners may also be directed to download by following the simple instructions below.

GETTING STARTED WITH SCRATCH

Scratch is a Graphical programming language developed at MIT Media Lab to help learners develop coding skill.

In Scratch, you can drag and drop, combine blocks of codes to make a program. It is like building blocks! For example, animations and games;



Start by launching Scratch Desktop

If Scratch Desktop is not already installed on your computer, you will need to install it.

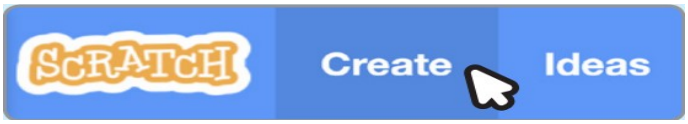
There are two versions of the Scratch offline editor available:

Use **Scratch Desktop 3.0** If your computer is running Windows 10 or higher, or macOS 10.13 or higher.

You can also use Scratch online at: scratch.mit.edu

Using Scratch online requires an internet connection.

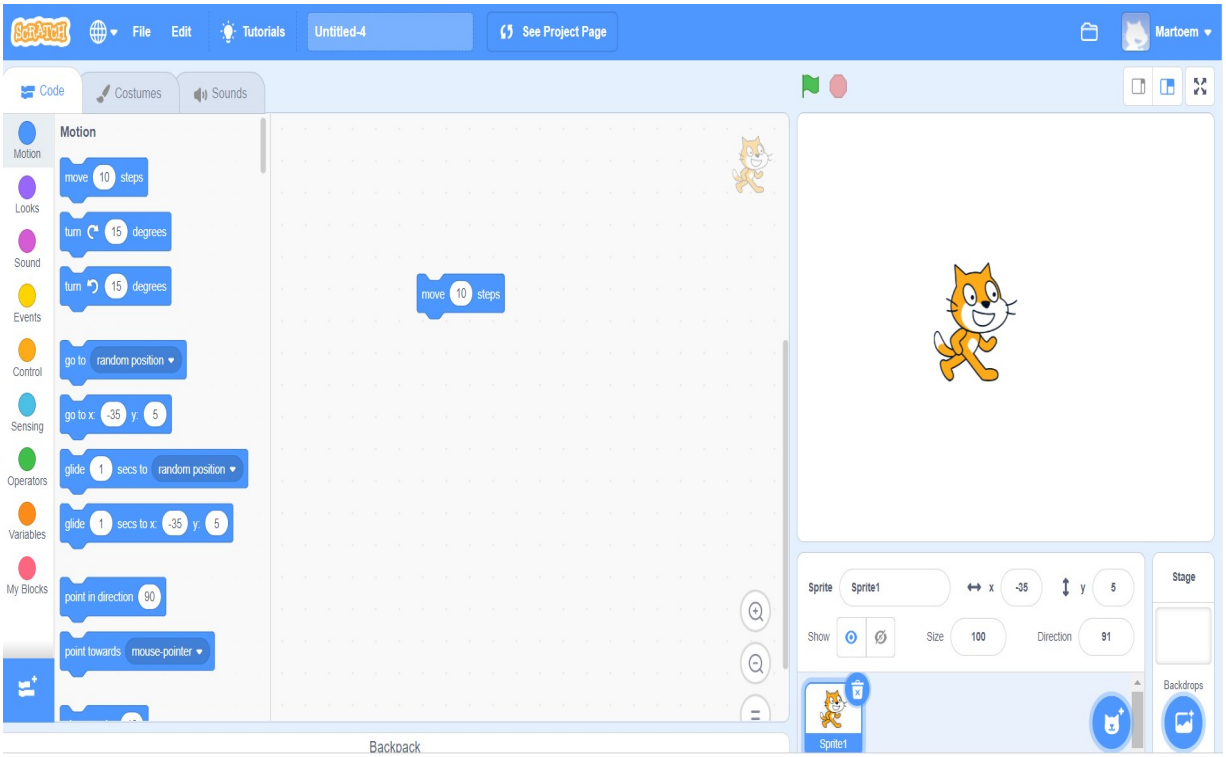
Once you've navigated to scratch.mit.edu,

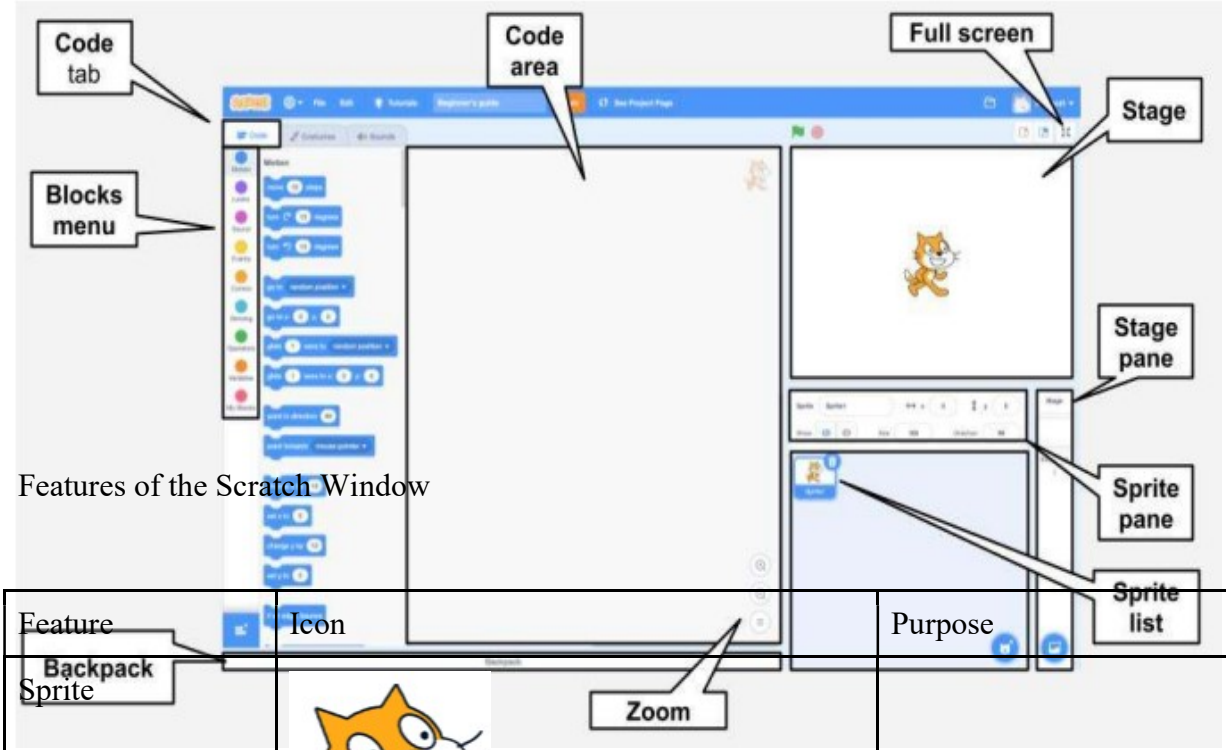


.

Click **Create** to get to the Scratch Editor

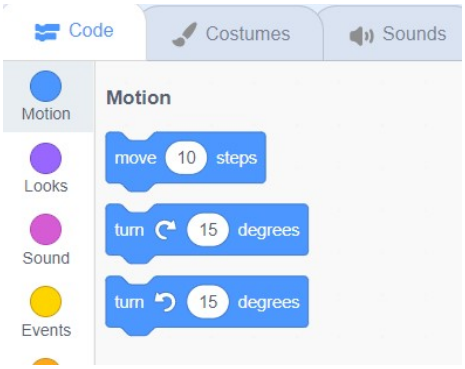
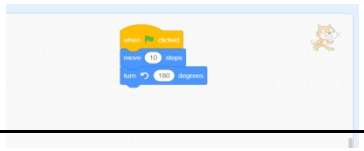
The SCRATCH Editor Window looks like this:





Features of the Scratch Window

Feature	Icon	Purpose
Sprite		

Blocks Menu		
Code area		
Stage area		
Sprite Panel		
Sprite List		

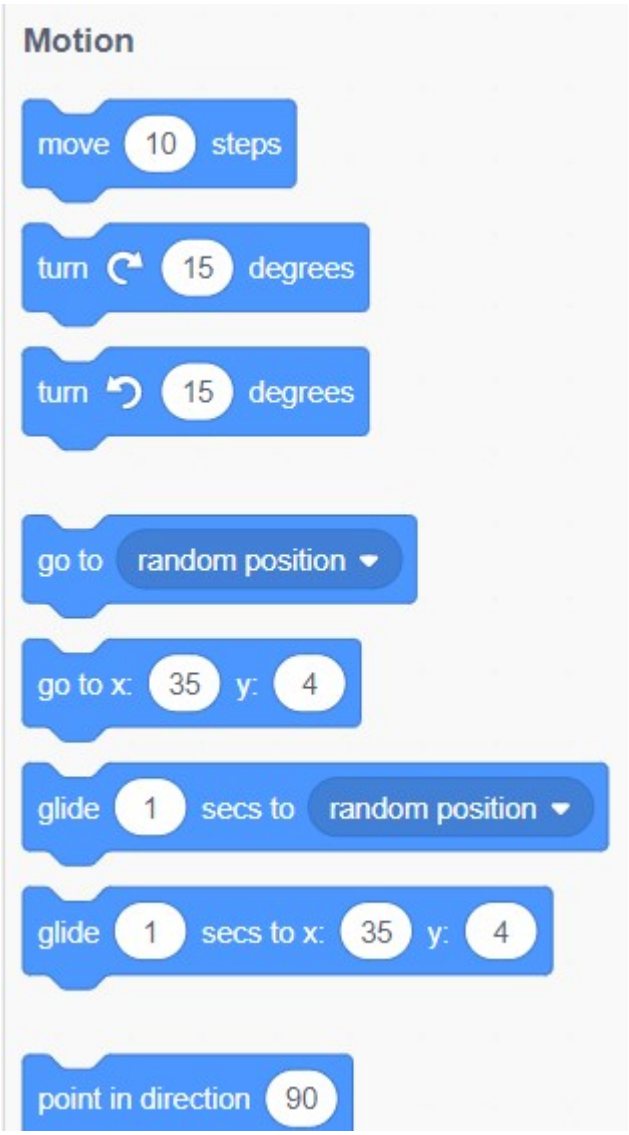
Activity **Work in Groups**

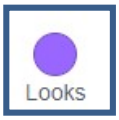
1. Open Scratch Program
2. Click on the Sprite {Insert the Sprite symbol} and drag
3. Select the motion block {insert the symbol}
4. Click on the move block and drag it to the command pane

On the blocks menu

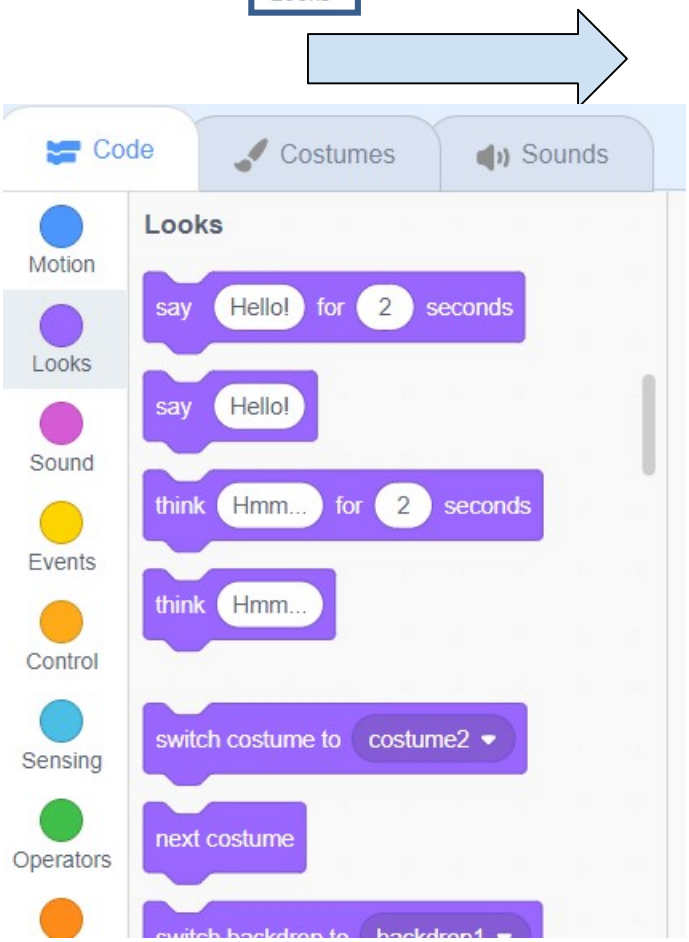
The motion Block  when clicked gives the following blocks among others

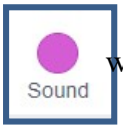

Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks


Motion
move 10 steps
turn 15 degrees
turn 15 degrees
go to random position
go to x: 35 y: 4
glide 1 secs to random position
glide 1 secs to x: 35 y: 4
point in direction 90

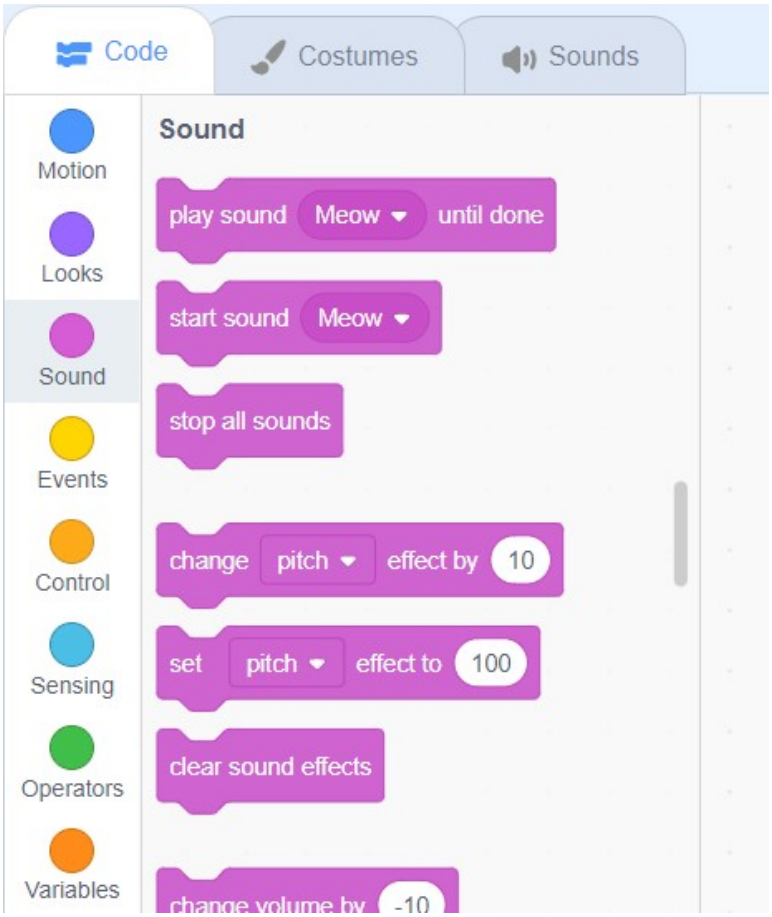
The Looks Blocks 

when clicked gives the following blocks among others



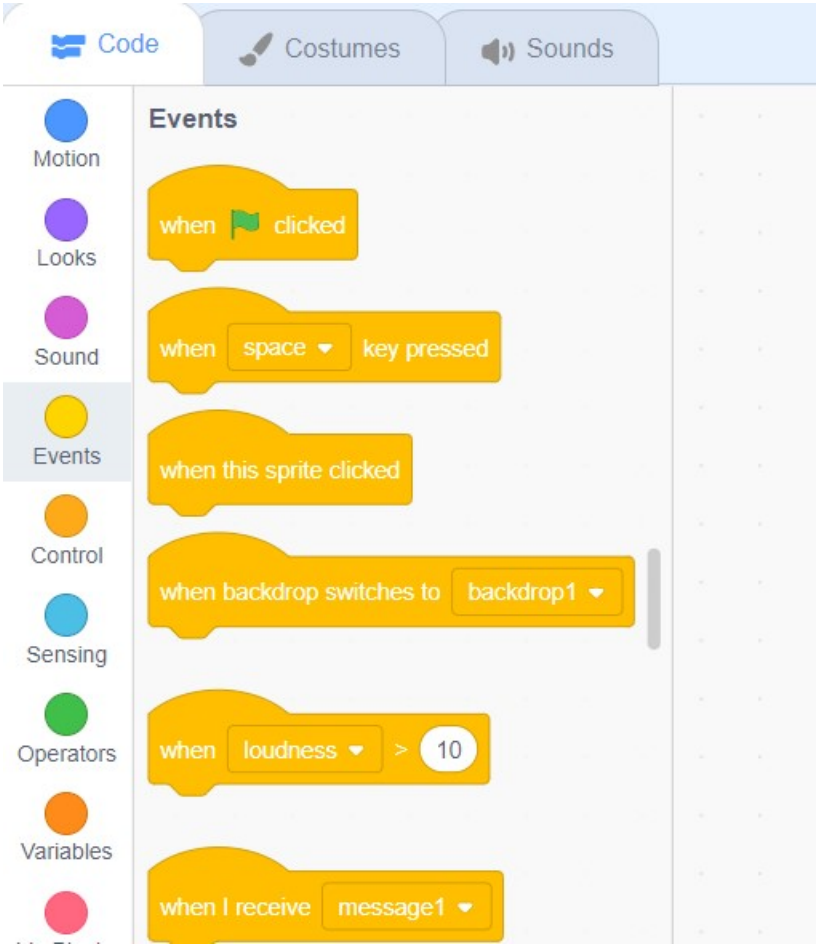
The Sound block 

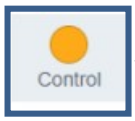
when clicked gives the following blocks among others



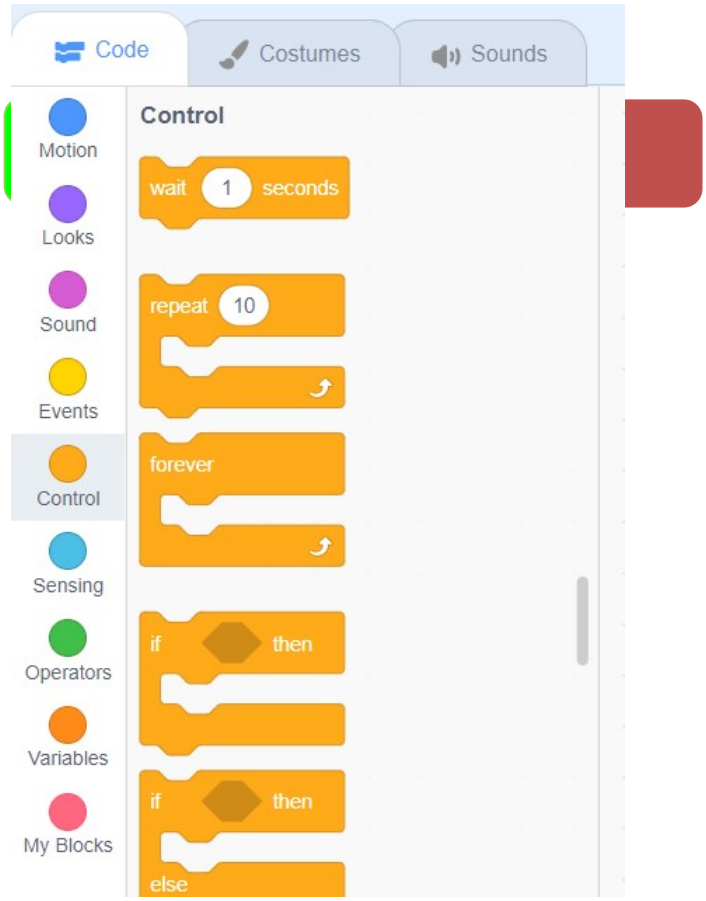
The Events block 

when clicked gives the following blocks among others



The Control block 

when clicked gives the following blocks among others



To make the Sprite move, follow the steps below

Step 1 - On the main tab, click on the **Events block**

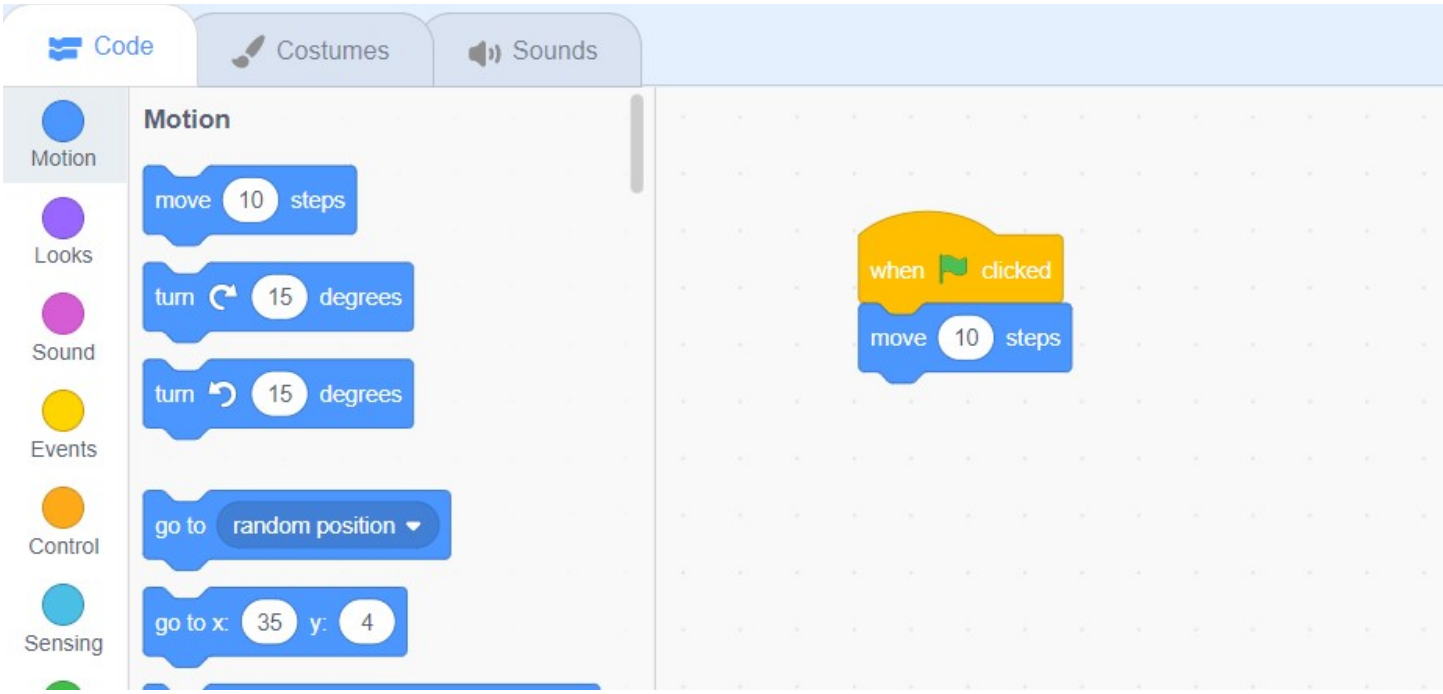
Step 2 - Click and drag **When Clicked** Block 

to the coding area

Step 3 - Click on the, 

then click and drag **move 10 steps** block to the coding area

Step 4 - place the move 10 steps block to lock with the when clicked block as shown below



Step 5 Click on the green flag at the top right corner 

UNIT THREE: Pertinent and Contemporary Issues: Alcohol and Drug Abuse

Introduction

Welcome to this section on pertinent and contemporary issues where we shall look at alcohol and drug abuse in learning institutions with a specific focus on basic institutions of learning. In this session you will find rationale, learning outcomes and the content which focuses on common sources of drugs in schools and effective strategies to prevent drugs and substance abuse in schools.

Rationale

Alcohol and drug abuse in basic institutions of learning is a growing problem that needs urgent attention (NACADA, 2020).Currently during this period of COVID-19, drug use among the learners has become rampant within the locality affecting on-going school children .This has caused delinquency, affecting social, psychological and physical symptoms. Teachers need to be equipped with skills on how to mitigate drug and substance use. Task forces and commissions of inquiry established to investigate indiscipline and students' unrest in the country have repeatedly pointed out at the alcohol and drug use in our learning institutions as a part of the problem. Surveys conducted by NACADA in primary (2018) and secondary schools (2016) showed that schools are not drug free places. It is important as teachers to understand effective strategies to apply to prevent drugs and substance use in schools because it is one of the pertinent and contemporary issues facing our institutions of learning. This is what informed inclusion of this session in the INSET.

Learning outcomes

By the end of the session, you should be able to

1) Describe strategies to identify current drug abuse among learners in learning institutions within your jurisdiction
2) Apply appropriate strategies to prevent drug abuse among learners in schools
3) Appreciate the importance of prevention of drug abuse among learners.

Sources of drugs in schools

Surveys conducted by NACADA in primary (2018) and secondary schools (2016) showed that schools are not drug free places. According to students, the sources of drugs in percentage are;

1) Friends (32.2%)
2) Relatives (16.7%),
3) Home (29.3%)
4) Supermarkets (11.3%)
5) Other students (25.7%)
6) Non-teaching school workers (7.4%)
7) Bought from a bar near school (22%)

8) Parents (5.3%)
9) A local brew den (19.1%)
10) Teachers (4.8%)
11) Kiosks or shop near school (16.9%)
12) School canteen (3.9%)

The surveys revealed that teachers were ill equipped to handle incidences of alcohol and drug use in schools.

Activity

Describe briefly your own assessment of current drug use among learners in learning institution within your jurisdiction

Identify some of the drugs that are being abused by learners in our institutions

What are some of the effective strategies that you can apply to prevent drug use among the learners in our schools?

Further reading: Access a document by NACADA called Teachers' Guide in the Google Classroom and read page 6 on effective strategies for use to prevent drug use among the learners in schools. It is highly recommended that you take time to read the booklet to gain knowledge in this area and share the information with others.

You may have come up with the following as methods to curb drug abuse:
To curb drugs and substance abuse, a multi-dimensional strategy should be adopted to enhance effectiveness. Some of the strategies are;

a) Addressing misconceptions regarding the normative nature and expectation of substance use – when young people think more of their peers use, it makes them more likely to use
b) Emphasizing immediate age appropriate consequences of substance use – young brains cannot process long term consequences
c) Addressing perceptions of risk or harm associated with drug use.
d) Developing School-based programs for awareness, guiding and counseling learners on the dangers of drug abuse.
e) Involving parents in behavior modification of learners including creation of family programs focusing on positive parenting.
f) Strengthening Guidance and Counseling in schools.
g) Adoption of a comprehensive collaborative approach involving both state and non-state actors key among them Ministry of Interior and Coordination of National Government, Ministry of Health, Ministry of Education, NACADA, County Governments, parents and guardians.

h) Modeling appropriate Behaviour regarding use of alcohol and drugs in school and during events is part of the action that can be taken

i) Talk to young people about drug use openly and communicate the facts, without lecturing or exaggerating. Educate them on the detrimental effects of drugs and substance abuse.

j) Praise good behaviour and achievements in learners while at the same time encourage learner participation in and out of the classroom.

k) Teaching life skills development especially assertiveness in resisting drug use.

l) Developing school rules with consequences that discourage drug use.

Conclusion

In this session, you found out that alcohol and drug abuse in basic institutions of learning is a growing problem that needs urgent attention. Some of the sources of drugs in the learning institutions include relatives, friends and even school staff. You also found out that indiscipline and learner's unrest in schools has been partly contributed by alcohol and drug abuse by the learners. It is hoped that having shared this session with your peers you will appreciate that there is need to join efforts in this campaign on prevention of drugs and substance use among youths in our school and learning institutions.

ASSESSMENT

You are expected to undertake the following assessment task:

1. Reflective journals: You are expected to prepare and upload in the google classroom a reflective journal. The reflective journal assessment rubric in table 8 provides a guide on what is expected in your reflective process. Having gone through the training course, reflect and put down your thoughts on; what you have learnt, what you wonder about and what more you need to enable learners meet the curriculum expectations .***Use the template provided in table 9 for your reflective journal entries***

Table 8: Reflective Journal Assessment Rubric

Criteria	Descriptor of the Highest Quality	Points awarded Maximum 20
What I Learned	An overview is written of what has been learned on a personal/professional basis about contents of the module. This overview is insightful and outlines what has been uncovered and discovered through various experiences, readings, and activities engaged in.	10/10
What I Still Wonder About	Deeply reflective, critical, questions are raised (nagging questions) that remain at the end of the course.	5/5
What I Need	Deeply reflective, critical, questions are raised (nagging questions) that remain at the end of the course.	5/5
Overall Comments: **Total Mark:20 /20**		

Adapted from KEMI Online TPD Course Module, 2022

Table 9: Template for your reflective journal entries

My Reflective Journal				
County:	Name:	TSC No.:	Subject:	School:
Topic		Points awarded Maximum 15		Facilitator's Comment
What I Learned		/10		
What I Still Wonder About		/5		
What I Need to learn		/5		
Overall Comments: **Total points: /20**				

Adapted from KEMI Online TPD Course Module, 2022

Grading criteria

What I have learnt (10points)	Exceeded Expectation ***More than 10points***	Met expectation ***10points***	Approached Expectation ***Less than 10points***
What I am still wondering about or did not understand (5points)	Exceeded Expectation ***More than 5points***	Met expectation ***5points***	Approached Expectation ***Less than 5 points***
What I need to learn (5points)	Exceeded Expectation ***More than 5points***	Met expectation ***5points***	Approached Expectation ***Less than 5points***
Overall assessment	Exceeded Expectation ***More than 20 points***	Met expectation ***20 points***	Approached Expectation ***Less than 20 points***

Certification

Upon successful completion of the module and submission of responses to the tasks given you will be awarded with a certificate of participation.

References

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Oxford (2019). Let's do Mathematics Learner's Book Grade 4

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TSC. 2018. Teacher Professional Development Policy Framework module one. Teachers Service Commission. Nairobi