Secondary Education Professional Development Programme

Professional Learning Community Handbook 3

Numeracy Across The Curriculum

HANDBOOK FOR **COORDINATORS**

Wisdom, Knowledge and Prudence

Ghana Education Service (GES)

NATIONAL TEACHING COUNCIL
NTC
Building Confidence, Raising Teaching Standards

GOVERNMENT OF GHANA

mastercard foundation

T-TEL
Transforming Teaching, Education & Learning

PROFESSIONAL LEARNING COMMUNITY HANDBOOK 3

NUMERACY ACROSS THE CURRICULUM

Coordinator Version

CONTENTS

FOREWORD

Continued teacher professional development cannot be overemphasized because educational needs are changing all the time and teachers need to be acquainted with these changes. The use of structured regular professional development activities for teachers, help them to improve their understanding of how to deliver effective learning outcomes.

In the light of this, the Ghana Education Service has collaborated with the National Teaching Council, tutors of Colleges of Education, teacher educators of some Universities and Technical Universities in Ghana as well as teachers from 12 Senior High Schools, Senior High Technical Schools, and Technical Institutes to develop this third Professional Learning Community (PLC) Handbook. This PLC Handbook is intended to assist heads and teachers of Secondary Schools to run weekly PLC sessions in schools. These sessions are dedicated periods in the school's weekly schedule where all teachers come together and work collaboratively to improve teaching and learning.

PLC sessions will help teachers to build a collective understanding of how to improve outcomes for all learners in their schools through a series of practical activities such as lesson study, team teaching and action research. The involvement of teachers from 12 Senior High Schools, Senior High Technical Schools and Technical Institutes in the writing of this Handbook means that the primary users of the Handbook are the ones who have been involved in its creation, helping to ensure its relevance and practicality.

This third PLC handbook, focuses on improving numeracy across the curriculum and covers the following topics:

- Relevant pedagogies that can support the delivery of the Secondary Education Curriculum
- The concept of teaching at the right level using differentiation
- Social and Emotional Learning (SEL)
- The concept and importance of numeracy across the curriculum
- Supporting the teaching and learning of numeracy at the right level in Information and Communication Technology (ICT)
- Supporting the teaching and learning of numeracy at the right level in Technical and Vocational Education and Training.
- Supporting the teaching and learning of numeracy at the right level in business studies
- Supporting the teaching and learning of numeracy at the right level in languages
- Supporting the teaching and learning of numeracy at the right level in science subjects
- Supporting the teaching and learning of numeracy at the right level in the social sciences
- Supporting numeracy across the curriculum through lesson observation.

Based on feedback from the use of the first two Handbooks, this third PLC Handbook is designed to further improve quality and relevance of teaching and learning through the use of strategies which promote Social and Emotional Learning (SEL) and teaching at the right level using differentiation.

The Handbook is structured in 11 generic Sessions which are appropriate for all SHS, SHTS and STEM schools and includes concepts specific to needs of technical institutes.

The hope and expectation is for this PLC Handbook to continue to play the much-needed role of supporting the transformation of our secondary education system and that it will be used effectively across all Ghanaian secondary education institutions.

Dr. Eric Nkansah
Director-General
Ghana Education Service

ACKNOWLEDGEMENTS

Many thanks to Robin Todd and all other members of the T-TEL team for contributing to the success of the writing of the manual in diverse ways.

The writing team was made up of the following contributors:

T-TEL TEAM			
Professor Jonathan Fletcher	T-TEL – Key Advisor, Teaching & Learning Partnerships		
Beryl Opong-Agyei	T-TEL – National Secondary Education Coordinator		
Alberta Djaaba Tackie	T-TEL – Curriculum Implementation, Teaching and Learning Coordinator		
Roger Kwamina Aikins	T-TEL – GM Commercial-Oversees Design, Print and Distribution		
WRITERS	**INSTITUTIONS**	**WRITERS**	**INSTITUTIONS**
Alidu Baba Iddrisu	Zabzugu Senior High School, Zabzugu	Josiah Bavachiga Kandwe	Walewale Technical Institute, Walewale
Esther Okaitsoe Armah	Mangoase Senior High School, Mangoase	Atikiba Eric	Nabango Senior High Technical School, Nabango
Adam Abubakari	Gambaga Girls Senior High School, Gambaga	N-yalamba Jerry Njomoun	E.P Agric Senior High Technical School, Tatale
Blessington Dzah	Ziavi Senior High Technical School, Ziavi	Avole Baba Ansbert	Bolgatanga Senior High School, Bolgatanga
Anthony Nyame	Bosome Senior High Technical School, Bosome	Salifu Hudu	Lambussie Senior High School, Lambussie
Benedicta Ama Yekua Etuaful	Ogyeedom Senior High Technical School, Gomoa Afransi	Sampson Dedey Baidoo	Benso Senior High Technical School, Benso
Dr. Kwaku Addo-Kissiedu	University for Development Studies, Tamale	Dr. Ann Dodor	Takoradi Technical University, Takoradi
Grace Annagmeng Mwini	Tumu College of Education, Tumu	Ambrose Ayikue	St. Francis College of Education, Hohoe
Maxwell Bunu	Ada College of Education, Ada	Eric Kwabena Abban	Mt. Mary College of Education, Somanya
Bernard Kuug	National Teaching Council	Faustina Graham	Ghana Education Service HQ

PROFESSIONAL LEARNING COMMUNITY HANDBOOK 3

NUMERACY ACROSS THE CURRICULUM – COORDINATOR VERSION

1. ***Background to the Professional Learning Community Sessions in this Handbook***

There are eleven weekly Professional Learning Community (PLC) Sessions in this Handbook, which aim to guide teachers to support the teaching of numeracy across the Senior High School (SHS) curriculum. The Sessions are not subject specific therefore teachers who teach Technical and Vocation Education and Training (TVET) subjects can use it as well.

In addition to supporting the teaching of numeracy across the SHS curriculum, the PLC Sessions are designed to support:

- Professionalising teaching by supporting teachers in developing communities of practice and enhancing their professionalism.
- Improving the learning outcomes and life chances for all learners.

2. Features of the PLC Sessions

- The main resources for the weekly teacher Sessions are the teacher version of the Handbook and the PLC Coordinator version of the Handbook.
- Both versions are written to provide information to guide the 11 weekly PLC Sessions that are linked directly to the teaching of numeracy.
- The PLC Coordinator version of the Handbook has prompts for leading the PLC Session.
- The teacher version of the Handbook contains activities for teachers and guidance for what they will do during the Session.
- The times suggested for the activities in the various sections of the Sessions are a guide only and can be reviewed as appropriate.
- The weekly PLC Sessions are of 90-minute duration although schools may extend this duration to enable teachers to complete the extension activities in specific sessions together.

PLC Session 1: Relevant pedagogies that can support the delivery of the Secondary Education Curriculum			
Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do and say during each session. Each bullet needs to be addressed	**Guidance Notes on Leading the session.** *What the PLC Coordinator will have to say during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking teachers to share two things they did differently in the classroom or elsewhere based on PLC Handbook 2*, on literacy across the curriculum*, which they think impacted learning positively. 1.2 Ask teachers to discuss and summarise in a single sentence why they think what a colleague did by way of application of lessons learned in PLC Handbook 2*, literacy across the curriculum*, supported learning.	1.1 Share two things you did differently in the classroom or elsewhere based on PLC Handbook 2*, on literacy across the curriculum,* which you think impacted learning positively. 1.2 Discuss and summarise in a single sentence why you think what your colleague did by way of application of lessons learned in PLC Handbook 2*, literacy across the curriculum*, supported learning.	20 mins

2. Planning for teaching, learning and assessment activities, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session. **Purpose:** The purpose of the session is to discuss relevant pedagogies that can support the delivery of the Senior High School /Technical, Vocational Education and Training (SHS/TVET) curriculum. LO1: Demonstrate knowledge, understanding and application of appropriate pedagogies that can support teaching and learning of the content of the SHS/TVET curriculum (NTS 2c, 2d, 2f, 3a, 3e - 3g, 3j and 3l). LI 1.1 Identify at least three appropriate pedagogies that can be used to deliver the SHS/TVET curriculum. LI 1.2 Discuss an example of appropriate pedagogies that support the delivery of SHS/TVET curriculum. LO2: Demonstrate knowledge and understanding of planning for integrating varied appropriate pedagogies in lessons (NTS 2c, 2d, 2f, 3a, 3e - 3g, 3j and 3l). LI 2.1 Discuss the benefits of using appropriate and varied pedagogies in the planning of lessons. LI 2.2 Examine different strategies of integrating	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session. **Purpose:** The purpose of the session is to discuss relevant pedagogies that can support the delivery of the Senior High School /Technical, Vocational Education and Training (SHS/TVET) curriculum. LO1: Demonstrate knowledge, understanding and application of appropriate pedagogies that can support teaching and learning of the content of the SHS/TVET curriculum (NTS 2c, 2d, 2f, 3a, 3e - 3g, 3j and 3l). LI 1.1 Identify at least three appropriate pedagogies that can be used to deliver the SHS/TVET curriculum. LI 1.2 Discuss an example of appropriate pedagogies that support the delivery of SHS/TVET curriculum. LO2: Demonstrate knowledge and understanding of planning for integrating varied appropriate pedagogies in lessons (NTS 2c, 2d, 2f, 3a, 3e - 3g, 3j and 3l). LI 2.1 Discuss the benefits of using appropriate and varied pedagogies in the planning of lessons. LI 2.2 Examine different strategies of integrating	30 mins

	appropriate varied pedagogies in lesson delivery. 2.2 Ask teachers in pairs to identify and share with their partners and the larger group, three appropriate pedagogies used across the curriculum (NTS 3e, 3g). *E.g.* *a) Science* *i. Demonstration* *ii. Practical method* *iii. Enquiry-Based Approach, etc.* *b) Mathematics* *i. Activity* *ii. Demonstration* *iii. Problem Solving, etc.* *c) English* *i. Brainwriting* *ii. Discussion* *iii. Drill, etc.* *d) Graphic Design* *a. Project-Based* *b. Demonstration* *c. Exhibition, etc.* 2.3 Ask teachers to discuss an example of appropriate pedagogies used across the SHS/TVET curriculum (NTS 2c, 3e and 3g). *E.g.* *a) Science* *i. Demonstration: A method of teaching concepts through showing steps and processes. It is generally used when processes and steps are complex, dangerous and materials are inadequate. When demonstrating, the*	appropriate varied pedagogies in lesson delivery. 2.2 In pairs, identify and share with your partners and the larger group, three appropriate pedagogies used across the curriculum (NTS 3e, 3g). *E.g.* *a) Science* *Practical method, etc.* *b) Mathematics* *Demonstration, etc.* *c) English* *Brainwriting, etc.* *d) Graphic Design* *Exhibition, etc.* 2.3 Discuss an example of appropriate pedagogies used across the SHS/TVET curriculum (NTS 2c, 3e and 3g). *E.g.* *a) Science* *Demonstration: A method of teaching concepts through showing steps and processes. It is generally used when processes and steps are complex, dangerous and materials are inadequate. When demonstrating, the*	

	teacher can direct the learners' attention to the relevant facts and application of scientific principles. This can be done using real or virtual instances *ii. Practical method: A hands-on approach used to teach concepts-which interdependently connects theory with practical task* *iii. Enquiry-Based Approach: This is an instructional method which enables the learners to seek knowledge through their own effort by means of investigations, etc.* *b) Mathematics* *i. Activity: It involves assigning learners tasks and allowing them to either perform them individually or in groups* *ii. Demonstration: It shows the processes involved in carrying out activities, and formulation of theorems either by the learner or the teacher* *iii. Problem Solving: It involves presenting scenarios or problems to learners*	*teacher can direct the learners' attention to the relevant facts and applications of scientific principles. This can be done using real or virtual instances, etc.* *b) Mathematics* *Activity: It involves assigning learners tasks and allowing them to either perform them individually or in groups, etc.*	

	and provide opportunities and support (when necessary) for them to find out varied solutions to the scenarios or problems, etc. *c) English* *i. Brainwriting: It involves writing or documenting thoughts and ideas about a particular concept or issue* *ii. Discussion: It involves expressing one's view or ideas about an issue or a concept orally or in writing. It could be in smaller groups or whole class* *iii. Drill: It is a systematic repetition of concepts that aim at the learner retaining the concept in a planned way, etc.* *d) Graphic Design* *i. Exhibition: It involves displaying artifacts or objects for the purpose of helping learners to identify key features of such objects* *ii. Project-Based: It involves carrying out given tasks in the form of projects* *iii. Demonstration: It shows how things are done using real or virtual instances, etc.*	*c) English* *Brainwriting: It involves writing or documenting thoughts and ideas about a particular concept or issue, etc.* *d) Graphic Design* *Exhibition: It involves displaying artifacts or objects for the purpose of helping learners to identify key features of such objects, etc.*	

	2.4 Ask teachers in groups to discuss the benefits of using appropriate and varied pedagogies in the planning of lessons (NTS 3e - 3g). *E.g.* *a) It provides room to attend to the needs of all learners at the right level* *b) It enables teachers to effectively deliver lessons that suit varied learning styles* *c) The teacher has the opportunity to create a suitable learning environment for the chosen pedagogies* *d) It informs the teacher of the appropriate teaching and learning resources needed for the lesson at the right level, etc.*	2.4 In groups, discuss the benefits of using appropriate and varied pedagogies in the planning of your lessons (NTS 3e - 3g). *E.g.* *It provides room to attend to the needs of all learners at the right level, etc.*	
	2.5 Ask teachers in subject groups to identify two factors to consider when integrating appropriate varied pedagogies in lesson delivery (NTS 3f, 3j and 3k). *E.g.* *a) Nature of the topic* *b) Expected lesson outcomes* *c) Abilities of learners* *d) Available teaching and learning resources* *e) Learning environment* *f) Assessment (as, for and of), etc.*	2.5 In your subject groups, identify two factors to consider when integrating appropriate varied pedagogies in lesson delivery (NTS 3f, 3j and 3k). *E.g.* *Nature of the topic, etc.*	
	2.6 Ask teachers to discuss two factors to consider when integrating appropriate varied	2.6 Discuss two factors to consider when integrating appropriate varied pedagogies	

	pedagogies in lesson delivery (NTS 3f, 3j and 3k). *E.g.* *a) Nature of the topic: Some topics may lean themselves to the use of practical activities, while others may favour the use of roleplay, discussion, drills, etc.* *b) Expected lesson outcomes: This will influence the type of pedagogy or teaching strategies to employ* *c) Abilities of learners: Differences in learners' levels of abilities call for the use of differentiated tasks to cater for the individual learner needs* *d) Available teaching and learning resources: Inadequate teaching and learning resources will make the teacher resort to the use of demonstrations or group work* *e) Learning environment: Large class sizes may make the teacher use whole class discussion, and lecture methods* *f) Assessment (as, for and of): The purpose of assessment strategies will influence the type of teaching pedagogy to use in a lesson delivery. For instance, if the purpose of assessment is to provide feedback to learners, a teacher may ask learners to demonstrate an activity for the teacher and other learners to make inputs, etc.*	in lesson delivery (NTS 3f, 3j and 3k). *E.g.* *Nature of the topic: Some topics may lean themselves to the use of practical activities, while others may favour the use of roleplay, discussion, drills, etc.*	

	2.7 Ask teachers to discuss a sample lesson plan in ICT and show how it can be taught using relevant pedagogies that can support the delivery of the SHS/TVET curriculum (NTS 1d, 2b - 2f, 3a, 3c, 3d and 3f - 3l). *Refer to Appendix 1 for a sample lesson plan in ICT in SHS 1.* 2.8 Ask teachers to indicate how the lesson will be taught using other appropriate pedagogies (NTS 2c, 2e, 2f, 3a and 3c-3l).	2.7 Discuss a sample lesson plan in ICT and show how it can be taught using relevant pedagogies that can support the delivery of the SHS/TVET curriculum (NTS 1d, 2b - 2f, 3a, 3c, 3d and 3f - 3l). *Refer to Appendix 1 for a sample lesson plan in ICT in SHS 1.* 2.8 Indicate how the lesson will be taught using other appropriate pedagogies (NTS 2c, 2e, 2f, 3a and 3c-3l).	
3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	3.1 Ask teachers to identify in the sample lesson plan, activities that could promote ICT, Gender Equality and Social Inclusion (GESI), 21st century skills, differentiation and Social and Emotional Learning (SEL) responsiveness (NTS 2e, 2f, 3c, 3d, 3f and 3g). *E.g.* *a) Learners were put in mixed-ability and heterogenous groups to research and write on the meaning of terminologies given (GESI/SEL/21st century skills/ differentiation)* *b) Teacher used mixed-gender groups during the activities on keywords (where possible) to encourage collaboration between males and females including SEN learners (GESI/SEL/21st century skills)* *c) Teacher provided one-on-one support to learners who struggled with associating the terms with*	3.1 Identify in the sample lesson plan, activities that could promote ICT, Gender Equality and Social Inclusion (GESI), 21st century skills, differentiation and Social and Emotional Learning (SEL) responsiveness (NTS 2e, 2f, 3c, 3d, 3f and 3g). *E.g.* *Learners were put in mixed-ability and heterogenous groups to research and write on the meaning of terminologies given, etc.*	30 mins

	their future learning expectations (GESI/SEL/differentiation) *d) Differentiated activities were used to cater for individual learners' needs and learning styles (GESI/SEL/differentiation)* *e) The teacher used the Internet and computers to aid in developing the ICT skills of learners (ICT)* *f) The teacher asked the learners to summarise the lesson, aiding in developing communication and leadership skills (21st century skills)* *g) Learners were asked to identify and record key terms that can assist in their future learning, and this helped in the individual learners reflecting on the topic and relating it to future learning expectations to develop critical thinking abilities, etc. (21st century skills)*		
	3.2 Ask teachers to recommend other appropriate assessment strategies that could be used to assess learning in the sample lesson plan (NTS 3k - 3n, 3p). *E.g.* *a) Peer reading* *b) Active listening* *c) Role-play* *d) Debate* *e) Dramatization* *f) Presentation, etc.*	3.2 Recommend other appropriate assessment strategies that could be used to assess learning in the sample lesson plan (NTS 3k - 3n, 3p). *E.g.* *Peer reading, etc.*	
	3.3 Ask a teacher to model a teaching activity based on the sample lesson plan that could	3.3 Model a teaching activity based on the sample lesson plan that could support learners who	

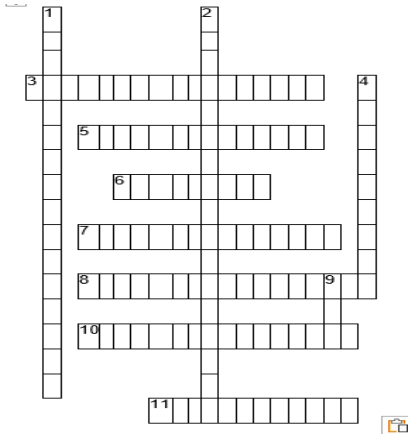
	support learners who may struggle with developing basic numeracy skills that can assist in their future learning taking into consideration GESI, SEL and 21st century skills (NTS 1d, 2b, 2c, 2e, 2f, 3a and 3c- 3l).	may struggle with developing basic numeracy skills that can assist in their future learning taking into consideration GESI, SEL and 21st century skills (NTS 1d, 2b, 2c, 2e, 2f, 3a and 3c- 3l).	
4. Evaluation and review of session: ➢ **Noting that teachers need to identify critical friends to observe lessons and report at next session**	4.1 Ask teachers in groups to reflect, write and share what they have learned with the larger group with regard to the relevant pedagogies that can support the delivery of the SHS/TVET curriculum (NTS 1a, 1b). 4.2 Remind teachers to, where possible, identify a critical friend to observe their lesson in relation to PLC Session 1 and provide feedback to them (NTS 3n, 3o). 4.3 Remind teachers to read PLC Session 2 in preparation for the next session.	4.1 In your group, reflect, write and share what you have learned with the larger group with regard to the relevant pedagogies that can support the delivery of the SHS/TVET curriculum (NTS 1a, 1b). 4.2 Where possible, identify a critical friend to observe your lesson in relation to PLC Session 1 and provide feedback to you (NTS 3n, 3o). 4.3 Read PLC Session 2 in preparation for the next session.	10 mins
Appendix 1	*a) Topic:* *Basic ICT Concepts* *b) Sub-Topic:* *Definition of key terminologies and related concepts* *c) Objectives:* *By the end of the lesson, learner will be able to explain at least four ICT related terminologies without referring to any material.* *d) Relevant Previous Knowledge:* *Learners can mention some ICT terminologies.* *e) Teaching and Learning Resources:*	*a) Topic:* *Basic ICT Concepts* *b) Sub-Topic:* *Definition of key terminologies and related concepts* *c) Objectives:* *By the end of the lesson, learner will be able to explain at least four ICT related terminologies without referring to any material.* *d) Relevant Previous Knowledge:* *Learners can mention some ICT terminologies.* *e) Teaching and Learning Resources:*	

	Internet as a resource, flash cards, computer, projector, etc. *f) Core Competencies: Creativity, innovation, communication skills, collaboration, leadership and personal development, critical thinking and problem solving* *g) Keywords: Information, communication, technology, mobile phone, computer, internet, social media, projector, camera* *h) Introduction: Play the game of win-win. Students are given flash cards with terminologies on them, and asked in mixed-gender groups of four to mention one terminology each. Each group has the opportunity to nominate the next group to mention the next term on a flash card in their possession and the game goes on till all flash cards are used.* *i) Teaching and Learning Activities:* *i. In groups of four, taking into account ability levels and gender, teacher drills learners on the right spelling of keywords, their relationship with the topic, and future expectation in terms of their future learning.* *ii. Use appropriate questioning techniques and linkages of word roots to assist all learners to come out*	*Internet as a resource, flash cards, computer, projector, etc.* *f) Core Competencies: Creativity, innovation, communication skills, collaboration, leadership and personal development, critical thinking and problem solving* *g) Keywords: Information, communication, technology, mobile phone, computer, internet, social media, projector, camera* *h) Introduction: Play the game of win-win. Students are given flash cards with terminologies on them, and asked in mixed-gender groups of four to mention one terminology each. Each group has the opportunity to nominate the next group to mention the next term on a flash card in their possession and the game goes on till all flash cards are used.* *i) Teaching and Learning Activities:* *i. In groups of four, taking into account ability levels and gender, teacher drills learners on the right spelling of keywords, their relationship with the topic, and future expectation in terms of their future learning.* *ii. Use appropriate questioning techniques and linkages of word roots to assist all learners to come out*	

	with the meaning of the terminologies given. *iii. Demonstrate how to search for a word on the Internet with the help of a computer and a projector for learners to observe.* *iv. In mixed-ability groups of four, assist learners to use the Internet to search for the meaning of at least four keywords identified.* *j) Core Points:* *i. Computer Security: Measures and controls that ensure the confidentiality of information. It includes antivirus, spyware protection, passwords and firewalls.* *ii. System Maintenance: The processes and methods of ensuring the health of the computer which includes system information and diagnosis, system clean up tools and automatic updating.* *iii. Antivirus: This is a software that searches for, detects and destroys viruses which could damage or corrupt the computer system.* *iv. Spyware Protection: This stops people from being able to illegally monitor other people's use of their computer, including the keys the*	*with the meaning of the terminologies given.* *iii. Demonstrate how to search for a word on the Internet with the help of a computer and a projector for learners to observe.* *iv. In mixed-ability groups of four, assist learners to use the Internet to search for the meaning of at least four keywords identified.* *j) Core Points:* *i. Computer Security: Measures and controls that ensure the confidentiality of information. It includes antivirus, spyware protection and firewalls.* *ii. System Maintenance: The processes and methods of ensuring the health of the computer which includes system information and diagnosis, system clean up tools and automatic updating.* *iii. Antivirus: This is a software that searches for, detects and destroys viruses which could damage or corrupt the computer system.* *iv. Spyware Protection: This stops people from being able to illegally monitor other people's use of their computer, including the keys the*	

	user types in, which could disclose personal banking details and passwords. *v. Disk Formatting:* *It is used to prepare a storage device so that it is ready to be used for the first time.* *vi. Firewalls:* *They restrict the incoming and outgoing access to a network.* *vii. Operating System:* *The low-level software that supports a computer's basic functions.* *viii. Utilities Programs:* *These assist in making hardware and devices work and communicate with one another.* *ix. Disk organisation:* *This includes formatting, file transfer and defragmentation software which assist in moving files from one location to another.* *x. AYO: Acronym for "As You Organise"* *k) Conclusion:* *Learners are made to summarise the lesson based on the expected learning outcomes.* *l) Evaluation:* *Solve the word puzzle given below and return them before the start of next lesson.* *Note:* *Level 1 learners to solve at least three of the puzzle items, Level 2 to solve at*	*user types in, which could disclose personal banking details and passwords.* *v. Disk Formatting:* *It is used to prepare a storage device so that it is ready to be used for the first time.* *vi. Firewalls:* *They restrict the incoming and outgoing access to a network.* *vii. Operating System:* *The low-level software that supports a computer's basic functions.* *viii. Utilities Programs:* *These assist in making hardware and devices work and communicate with one another.* *ix. Disk organisation:* *includes formatting, file transfer and defragmentation software which assist in moving files from one location to another.* *x. AYO: Acronym for "As You Organise"* *k) Conclusion:* *Learners are made to summarise the lesson based on the expected learning outcomes.* *l) Evaluation:* *Solve the word puzzle given below and return them before the start of next lesson.* *Note:* *Level 1 learners to solve at least three of the puzzle items, Level 2 to*	

least six of the puzzle items and Level 3 learners to solve all



Across

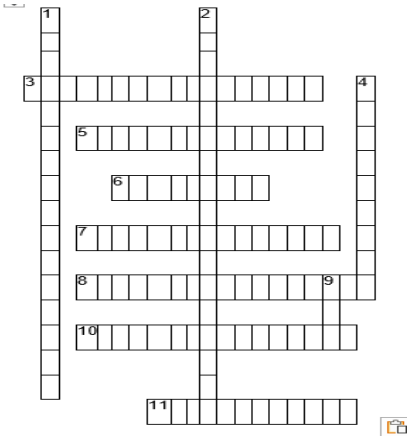
3. stops people from being able to illegally monitor other peoples' use of their computer, including the keys the user types in, which could disclose personal banking details and passwords.
5. It is used to prepare a storage device so that it is ready to be used for the first time.
6. restrict the incoming and outgoing access to a network by analysing the data and determining whether it should be allowed through or not, based on a predetermined set of rules.
7. the low-level software that supports a computer's basic functions, such as scheduling tasks and controlling peripherals.
8. can be grouped into three main categories
10. includes formatting, file transfer and defragmentation.
11. software assists in moving files from one computer system to another. It will make sure that the correct number of data packets are sent at the expected time and that the data is in a suitable format to be transferred.

Down

1. includes antivirus, spywa protection and firewalls.
2. includes system informat and diagnosis, system clea tools and automatic updatir
4. software searches for, detects and destroys viruse which could damage or cor the computer system.
9. Acronym for "As You Organise"

m) Remarks:

solve at least six of the puzzle items and Level 3 learners to solve all



Across

3. stops people from being able to illegally monitor other peoples' use of their computer, including the keys the user types in, which could disclose personal banking details and passwords.
5. It is used to prepare a storage device so that it is ready to be used for the first time.
6. restrict the incoming and outgoing access to a network by analysing the data and determining whether it should be allowed through or not, based on a predetermined set of rules.
7. the low-level software that supports a computer's basic functions, such as scheduling tasks and controlling peripherals.
8. can be grouped into three main categories
10. includes formatting, file transfer and defragmentation.
11. software assists in moving files from one computer system to another. It will make sure that the correct number of data packets are sent at the expected time and that the data is in a suitable format to be transferred.

Down

1. includes antivirus, spyw protection and firewalls.
2. includes system informa and diagnosis, system cle tools and automatic updat
4. software searches for, detects and destroys virus which could damage or co the computer system.
9. Acronym for "As You Organise"

m) Remarks:

PLC Session 2: The concept of teaching at the right level using differentiation			
Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do and say during each session. Each bullet needs to be addressed	**Guidance notes on Leading the session.** *What the PLC Coordinator will have to say during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking teachers to share what they did differently in the classroom or elsewhere based on PLC Session 1, on *relevant pedagogies that support the delivery of secondary education curriculum*, which they think impacted learning positively. 1.2 Ask teachers to discuss and summarise in a single sentence why they think what a colleague did by way of application of what they learned in Session 1, on *relevant pedagogies that support the delivery of secondary education*	1.1 Share what you did differently in the classroom or elsewhere based on PLC Session 1, on *relevant pedagogies that support the delivery of secondary education curriculum*, which you think impacted learning positively. 1.2 Discuss and summarise in a single sentence why you think what your colleague did by way of application of what you learned in Session 1, on *relevant pedagogies that support the delivery of secondary education curriculum*, supported learning.	20 mins

	curriculum, supported learning.		
2. Planning for teaching, learning and assessment activities, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session. **Purpose:** The purpose of the session is to discuss the concept of teaching at the right level using differentiation. LO 1: Demonstrate knowledge, understanding and application of the concept of teaching at the right level using differentiation (NTS 3e - 3j). LI 1.1 Explain the concept of teaching at the right level. LI 1.2 Explain the concept and aspects of differentiation. LO 2: Demonstrate understanding of planning multi-level lessons using differentiation (NTS 3a, 3c - 3p). LI 2.1 Identify and discuss the strategies of teaching at the right level. LI 2.2 Give examples of planning, teaching and assessing multi-level lessons using differentiation. 2.2 Ask teachers in pairs to explain to their partners and share with the larger group the concept and aspects of	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session. **Purpose:** The purpose of the session is to discuss the concept of teaching at the right level using differentiation. LO 1: Demonstrate knowledge, understanding and application of the concept of teaching at the right level using differentiation (NTS 3e - 3j). LI 1.1 Explain the concept of teaching at the right level. LI 1.2 Explain the concept and aspects of differentiation. LO 2: Demonstrate understanding of planning multi-level lessons using differentiation (NTS 3a, 3c - 3p). LI 2.1 Identify and discuss the strategies of teaching at the right level. LI 2.2 Give examples of planning, teaching and assessing multi-level lessons using differentiation. 2.2 In pairs explain to your partner and share with the larger group the concept and aspects of differentiation across the curriculum (NTS 3i).	30 mins

	differentiation across the curriculum (NTS 3i). *E.g.* ***a) Concept:*** *i. Differentiation is the process by which differences between learners are accommodated so that all learners in a group have best chances of learning. Differentiation can be achieved by task, outcome, learning activity, pace and learning needs. It also ensures that each learner benefits adequately from the delivery of the curriculum* *ii. Differentiation is the use of a variety of teaching methods, strategies, activities and assessment during a single lesson to ensure that all learners achieve equitable learning outcomes, etc.* ***b) Aspects:*** *i. Differentiation by task involves setting different assignments for learners of different abilities. One way to achieve this may be to produce different sets of exercises depending on learners' abilities* *ii. Differentiation by outcome is where the teacher sets a task and instead of working*	*E.g.* ***a) Concept:*** *Differentiation is the process by which differences between learners are accommodated so that all learners in a group have best chances of learning. Differentiation can be achieved by task, outcome, learning activity, pace and learning needs. It also ensures that each learner benefits adequately from the delivery of the curriculum, etc.* ***b) Aspects:*** *Differentiation by task involves setting different assignments for learners of different abilities. One way to achieve this may be to produce different sets of exercises depending on learners' abilities, etc.*	

	towards a single right answer, learners arrive at a personalised outcome depending on their abilities *iii. Differentiation by learning activity is a teaching approach that involves offering learners different ways to learn and demonstrate their understanding of a concept or skill* *iv. Differentiation by pace is a teaching approach where teachers adjust the speed at which they deliver content or assign tasks based on individual learner needs* *v. Differentiation by learning needs refers to a teaching approach that tailors teaching to all learners' learning needs, etc.* 2.3 Ask teachers to discuss at least three benefits of differentiation across the curriculum (NTS 2b - 2f, 3a and 3f - 3j). *E.g.* *a) Encourages maximum learner engagements* *b) Provides learners with the opportunity to engage with the content and improve in their learning* *c) Allows learners to learn in their own ways at their own pace* *d) Encourages social and academic inclusivity*	2.3 Discuss at least three benefits of differentiation across the curriculum (NTS 2b - 2f, 3a and 3f - 3j). *E.g.* *Encourages maximum learner engagements, etc.*	

	e) Promotes greater confidence for learners *f) Addresses issues by dealing with learners of varied abilities and responds to their individual needs (Konstantinou-Katzia, 2013), etc.* 2.4 Ask teachers to discuss a sample lesson plan in integrated science and show how it can be taught using differentiation to cater for learners who may struggle with the concepts of diffusion and osmosis (NTS 2b, 2e, 2f and 3c - 3p). *Refer to Appendix 2 for a sample lesson plan in Integrated Science for SHS 1(Basic 10)* 2.5 Ask teachers to indicate how the lesson will be taught using other appropriate methods. *E.g.* *a) Scaffolding* *b) Subject Portfolio Activity, etc.*	2.4 Discuss a sample lesson plan in integrated science and show how it can be taught using differentiation to cater for learners who may struggle with the concepts of diffusion and osmosis (NTS 2b, 2e, 2f and 3c - 3p). *Refer to Appendix 2 for a sample lesson plan in Integrated Science for SHS 1 (Basic 10)* 2.5 Indicate how the lesson will be taught using other appropriate methods. *E.g.* *Scaffolding, etc.*	
3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st	3.1 Ask teachers to identify in the sample lesson plan, activities that could promote GESI, SEL responsiveness, ICT, differentiation and 21st century skills (NTS 3f). *E.g.* *a) Learners worked in pairs, mixed-gender and mixed-ability groups to perform the experiment on diffusion (GESI)* *b) Teacher engaged learners to work in*	3.1 Identify in the sample lesson plan, activities that could promote GESI, SEL responsiveness, ICT, differentiation and 21st century skills (NTS 3f). *E.g.* *Learners worked in pairs, mixed-gender and mixed-ability groups to perform the experiment on diffusion, etc.*	30 mins

century skills	*pairs and in mixed-gender groups (where possible) to encourage collaboration between males and females including SEN learners (GESI/21st century skills)* *c) Teacher provided individualised support to learners who struggled with the steps involved in carrying out the experiments on diffusion (SEL/Differentiation)* *d) Differentiated activities for level 1, 2 and 3 learners on diffusion and osmosis were provided (Differentiation)* *e) Learners watched pre-recorded/YouTube videos on diffusion and osmosis to consolidate knowledge (ICT) etc.*		
	3.2 Ask teachers to recommend other appropriate strategies that could aid in the teaching of diffusion and osmosis using differentiation at the right level (NTS 3k - 3p). *E.g.* *a) Computer animations* *b) Annotated diagrams* *c) White-board illustrations* *d) Presentation, etc.*	3.2 Recommend other appropriate strategies that could aid in the teaching of diffusion and osmosis using differentiation at the right level (NTS 3k - 3p). *E.g.* *Computer animations, etc.*	
	3.3 Ask teachers to show how ICT can be used in assessing science learners practically (NTS 3j).	3.3 Show how ICT can be used in assessing science learners practically (NTS 3j).	15 mins

	E.g. *a) Watching YouTube/Pre-recorded videos and podcast with questions embedded on how osmosis and diffusion occur* *b) Giving learners assignments to be presented in PowerPoint* *c) Giving learners projects to search online for information* *d) Using google forms to quiz learners, etc.* 3.4 Ask a teacher to model a teaching activity based on the sample lesson plan that can support learners who may struggle with the concepts of diffusion and osmosis taking into consideration GESI, SEL, ICT, 21st century skills and differentiation for feedback from their colleagues (NTS 1a, 2c and 3e).	*E.g.* *Watching YouTube/Pre-recorded videos and podcast with questions embedded on how osmosis and diffusion occur, etc.* 3.4 Model a teaching activity based on the sample lesson plan that can support learners who may struggle with the concepts of diffusion and osmosis taking into consideration GESI, SEL, ICT, 21st century skills and differentiation for feedback from your colleagues (NTS 1a, 2c and 3e).	
4. Evaluation and review of session: ➢ **Noting that teachers need to identify critical friends to observe lessons and report**	4.1 Ask teachers in groups to reflect, write and share what they have learned with the larger group with regard to the concept of teaching at the right level using differentiation (NTS 1a, 1b). 4.2 Remind teachers to, where possible, identify a critical friend to observe their lesson in relation to PLC Session 2 and provide feedback to them (NTS 3n, 3o). 4.3 Remind teachers to read and bring along any relevant	4.1 In your group, reflect, write and share what you have learned with the larger group with regard to the concept of teaching at the right level using differentiation (NTS 1a, 1b). 4.2 Where possible, identify a critical friend to observe your lesson in relation to PLC Session 2 and provide feedback to you (NTS 3n, 3o). 4.3 Read and bring along any relevant materials for PLC	10 mins

at next session	materials for PLC Session 3 in preparation for the next session.	Session 3 in preparation for the next session.	
Appendix 2	*A sample lesson plan for teaching Integrated Science using differentiation to learners who may struggle with the concepts of diffusion and osmosis:* *a) Topic: Movement of substances into and out of cells* *b) Sub-topic: Diffusion and Osmosis* *c) Objectives: By the end of the lesson, the learner will be able to:* *i. Explain the term 'diffusion' correctly* *ii. Demonstrate how diffusion occurs in liquids* *iii. Explain the term 'osmosis' correctly* *iv. Discuss the differences among hypertonic, hypotonic and isotonic solutions* *d) Teaching and Learning Resources (TLRs): Highly scented bottle of perfume, water, potassium permanganate, beaker, stirrer, projector, worksheets, laptop/computer and pre-recorded/YouTube videos on diffusion and osmosis.* *e) Relevant Previous Knowledge (RPK):* *i. Learners detect the aroma of*	*A sample lesson plan for teaching Integrated Science using differentiation to learners who may struggle with the concepts of diffusion and osmosis:* *a) Topic: Movement of substances into and out of cells* *b) Sub-topic: Diffusion and Osmosis* *c) Objectives: By the end of the lesson, the learner will be able to:* *i. Explain the term 'diffusion' correctly* *ii. Demonstrate how diffusion occurs in liquids* *iii. Explain the term 'osmosis' correctly* *iv. Discuss the differences among hypertonic, hypotonic and isotonic solutions* *d) Teaching and Learning Resources (TLRs): Highly scented bottle of perfume, water, potassium permanganate, beaker, stirrer, projector, worksheets, laptop/computer and pre-recorded/YouTube videos on diffusion and osmosis.* *e) Relevant Previous Knowledge (RPK):* *i. Learners detect the aroma of stew/soup*	

	stew/soup being prepared in the kitchen. *ii. Some learners observe water droplets on surfaces of leaves.* *f) Introduction:* *Revise learners' RPK using the following questions;* *i. what process makes it possible for you to detect the aroma of stew/soup being prepared in the kitchen as you pass by. (Expected answers: wind, diffusion)* *ii. name the main process that makes it possible for water to move from one cell to another in plants. (Expected answer: osmosis)* *Note:* *Share specific objectives with learners* *g) Tasks/Activities:* *Activity 1:* *Learners work individually, in mixed-gender and mixed-ability groups to perform the following activity to establish diffusion.* *Step 1:* *Pick up a bottle of highly scented perfume*	*being prepared in the kitchen.* *ii. Some learners observe water droplets on surfaces of leaves.* *f) Introduction:* *Revise learners' RPK using the following questions;* *i. what process makes it possible for you to detect the aroma of stew/soup being prepared in the kitchen as you pass by. (Expected answers: wind, diffusion)* *ii. name the main process that makes it possible for water to move from one cell to another in plants. (Expected answer: osmosis)* *Note:* *Share specific objectives with learners* *g) Tasks/Activities:* *Activity 1:* *Learners work individually, in mixed-gender and mixed-ability groups to perform the following activity to establish diffusion.* *Step 1:* *Pick up a bottle of highly scented perfume*	

	and move to one corner of the classroom closing all doors and windows and smell the initial scent in the class. *Note:* *Take precaution to protect learners who are allergic to strong smell.* *Step 2:* *Put few drops of the scented perfume on the floor.* *Step 3:* *Move to the opposite corner of the classroom and ask learners to tell their observation and draw a conclusion.* *Observation:* *Learners will observe that:* *i. The scent of the perfume was intense at the spot where it was initially sprayed (region of higher molecular concentration) than the rest of the class.* *ii. After five (5) minutes, the smell of the perfume was evenly distributed throughout the classroom.*	*and move to one corner of the classroom closing all doors and windows and smell the initial scent in the class.* *Note:* *Take precaution to protect learners who are allergic to strong smell.* *Step 2:* *Put few drops of the scented perfume on the floor.* *Step 3:* *Move to the opposite corner of the classroom and ask learners to tell their observation and draw a conclusion.* *Observation:* *Learners will observe that:* *i. The scent of the perfume was intense at the spot where it was initially sprayed (region of higher molecular concentration) than the rest of the class.* *ii. After five (5) minutes, the smell of the perfume was evenly distributed throughout the classroom.*	

	Activity 2: *Learners work in pairs and in mixed-ability, mixed-gender groups (where possible) to perform the following activities to determine diffusion in liquids:* *Step 1:* *Half fill 250cm^3 beaker with water.* *Step 2:* *Put few grains of potassium permanganate into the water that is in the beaker.* *Step 3:* *Leave the beaker on a flat table/surface for about 20 minutes.* *Step 4:* *Stir the mixture with a stirrer for about two (2) minutes for easy spread of the potassium permanganate.* *Step 5:* *Critically observe the water in the beaker every 5 minutes and share your observation and draw a conclusion.* *Observation:* *Learners note that:* *i. The grains of potassium permanganate spreads slowly in the water and eventually attains a*	*Activity 2:* *Learners work in pairs and in mixed-ability, mixed-gender groups (where possible) to perform the following activities to determine diffusion in liquids:* *Step 1:* *Half fill 250cm^3 beaker with water.* *Step 2:* *Put few grains of potassium permanganate into the water that is in the beaker.* *Step 3:* *Leave the beaker on a flat table/surface for about 20 minutes.* *Step 4:* *Stir the mixture with a stirrer for about two (2) minutes for easy spread of the potassium permanganate.* *Step 5:* *Critically observe the water in the beaker every 5 minutes and share your observation and draw a conclusion.* *Observation:* *Learners note that:* *i. The grains of potassium permanganate spreads slowly in the water and*	

	state of equilibrium. *ii. The water turns to purplish colour.* *Activity 3:* *Learners think-pair-share the meaning of the terms hypertonic, hypotonic and isotonic solutions in groups of six (6).* *Activity 4:* *Using talking points strategy, ask learners to explain the concept of osmosis in their groups.* *Activity 5:* *In mixed-ability groups, learners discuss the differences among the terms: hypertonic, hypotonic and isotonic solutions.* *Activity 6:* *Learners watch pre-recorded/YouTube videos on diffusion and osmosis to consolidate knowledge.* *Note:* *The video should have background commentary to help SEN learners.* *h) Core Points:* *i. Keywords:* ➢ *Diffusion* ➢ *Osmosis* ➢ *Hypertonic solution*	*eventually attains a state of equilibrium.* *ii. The water turns to purplish colour.* *Activity 3:* *Learners think-pair-share the meaning of the terms hypertonic, hypotonic and isotonic solutions in groups of six (6).* *Activity 4:* *Using talking points strategy, ask learners to explain the concept of osmosis in their groups.* *Activity 5:* *In mixed-ability groups, learners discuss the differences among the terms: hypertonic, hypotonic and isotonic solutions.* *Activity 6:* *Learners watch pre-recorded/YouTube videos on diffusion and osmosis to consolidate knowledge.* *Note:* *The video should have background commentary to help SEN learners.* *h) Core Points:* *i. Keywords:* ➢ *Diffusion* ➢ *Osmosis* ➢ *Hypertonic solution*	

	➢ *Hypotonic solution* ➢ *Isotonic solution* ii. *Explanation of the term diffusion: Diffusion is the movement of molecules or particles from a region of higher molecular concentration to a region of lower molecular concentration until the particles are evenly distributed and a dynamic equilibrium established. Diffusion can only occur if a concentration gradient is established.* iii. *Explanation of the term osmosis: Osmosis is the movement of water (solvent) molecules from a region of higher molecular concentration to a region of lower molecular con centration through a semi-permeable membrane. Osmosis can only take place if osmotic gradient is established.* iv. *Hypertonic Solution is a solution which has a higher solute concentration than*	➢ *Hypotonic solution* ➢ *Isotonic solution* ii. *Explanation of the term diffusion: Diffusion is the movement of molecules or particles from a region of higher molecular concentration to a region of lower molecular concentration until the particles are evenly distributed and a dynamic equilibrium established. Diffusion can only occur if a concentration gradient is established.* iii. *Explanation of the term osmosis: Osmosis is the movement of water (solvent) molecules from a region of higher molecular concentration to a region of lower molecular con centration through a semi-permeable membrane. Osmosis can only take place if osmotic gradient is established.* iv. *Hypertonic Solution is a solution which has a higher solute concentration than that*	

	that of the cell being compared with. *v. Hypotonic Solution is a solution which has a lower solute concentration than that of the cell being compared with.* *vi. Isotonic Solution is a solution which has an equal/the same solute concentration as that of the cell being compared with.* *i) Core Competencies:* *i. Problem-solving skills* *ii. Critical thinking* *iii. Collaborative learning skills* *iv. Communication skills* *v. Leadership skills* *j) Conclusion:* *Draw learners' attention to the end of the lesson.* *Summarise the lesson by asking learners in their groups to tell what they have learned.* *Give exercise, mark and provide feedback to the learners individually.* *Assign an activity for the next lesson.* *i. Learners carry out the activities on the worksheets given out to the class demonstrating how diffusion occurs (Level 1)* *ii. Learners further explain what is meant by concentration and osmotic gradients.*	*of the cell being compared with.* *v. Hypotonic Solution is a solution which has a lower solute concentration than that of the cell being compared with.* *vi. Isotonic Solution is a solution which has an equal/the same solute concentration as that of the cell being compared with.* *i) Core Competencies:* *i. Problem-solving skills* *ii. Critical thinking* *iii. Collaborative learning skills* *iv. Communication skills* *v. Leadership skills* *j) Conclusion:* *Draw learners' attention to the end of the lesson.* *Summarise the lesson by asking learners in their groups to tell what they have learned.* *Give exercise, mark and provide feedback to the learners individually.* *Assign an activity for the next lesson.* *i. Learners carry out the activities on the worksheets given out to the class demonstrating how diffusion occurs (Level 1)* *ii. Learners further explain what is meant by concentration and osmotic gradients.*	

	(Level 2) *iii. Additionally, learners explain the effect of stirring on the mixture of water and potassium permanganate.* *(Level 3)* *k) Evaluation:* *i. Explain the term diffusion.* *ii. Demonstrate how diffusion occurs in liquids.* *iii. Differentiate among Hypertonic, Hypotonic and Isotonic Solutions.* *iv. Explain the effect of osmosis on a plant cell when it is placed in a hypertonic, hypotonic and isotonic solutions.* *v. Explain the effect of osmosis on an animal cell when it is placed in a hypertonic, hypotonic and isotonic solutions.* *l) Remarks:*	*(Level 2)* *iii. Additionally, learners explain the effect of stirring on the mixture of water and potassium permanganate.* *(Level 3)* *k) Evaluation:* *i. Explain the term diffusion.* *ii. Demonstrate how diffusion occurs in liquids.* *iii. Differentiate among Hypertonic, Hypotonic and Isotonic Solutions.* *iv. Explain the effect of osmosis on a plant cell when it is placed in a hypertonic, hypotonic and isotonic solutions.* *v. Explain the effect of osmosis on an animal cell when it is placed in a hypertonic, hypotonic and isotonic solutions.* *l) Remarks:*	

PLC Session 3: Social and Emotional Learning (SEL)			
Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do or say during each session. Each bullet needs to be addressed	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking teachers to share what they did differently in the classroom or elsewhere based on PLC Session 2, on *the concept of teaching at the right level using differentiation*, which they think impacted learning positively. 1.2 Ask teachers to discuss and summarise in a single sentence, why they think what their colleague did by way of application of what they learned in Session 2, on *the concept of teaching at the right level using differentiation*, supported learning.	1.1 Share what you did differently in the classroom or elsewhere based on PLC Session 2, on *the concept of teaching at the right level using differentiation,* which you think impacted learning positively. 1.2 Discuss and summarise in a single sentence, why you think what your colleague did by way of application of what you learned in Session 2, on *the concept of teaching at the right level using differentiation*, supported learning.	20 mins
2. Planning for teaching, learning and assessment activities, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL,	2.1 Ask a teacher to read the purpose, introduction to Social and Emotional Learning (SEL), the Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	2.1 Read the purpose, introduction to Social and Emotional Learning (SEL), the Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	30 mins

ICT and 21st century skills	**Purpose:** The purpose of the session is to guide teachers to; a) have a clear understanding of SEL competencies b) take SEL competencies into account in the teaching and learning process c) implement SEL in other aspects of school life d) engage teachers on how to encourage learners to take SEL into account in their learning. **Introduction to SEL:** Social and emotional learning refers to the process through which learners learn to understand and manage emotions; set and achieve positive goals; feel and show empathy for others; establish and maintain positive relationships; and make responsible decisions (Weissberg, *et al*., 2015). Teaching involves addressing learners' emotional, social and behavioural needs. With the right support, learners learn to articulate and manage their own emotions. They are able to deal with conflict and solve problems if they are given the appropriate guidance. Also, learners are able to understand things from other people's perspective and	**Purpose:** The purpose of the session is to guide teachers to; a) have a clear understanding of SEL competencies b) take SEL competencies into account in the teaching and learning process c) implement SEL in other aspects of school life d) engage teachers on how to encourage learners to take SEL into account in their learning. **Introduction to SEL:** Social and emotional learning refers to the process through which learners learn to understand and manage emotions; set and achieve positive goals; feel and show empathy for others; establish and maintain positive relationships; and make responsible decisions (Weissberg, *et al*., 2015). Teaching involves addressing learners' emotional, social and behavioural needs. With the right support, learners learn to articulate and manage their own emotions. They are able to deal with conflict and solve problems if they are given the appropriate guidance. Also, learners are able to understand things from other people's perspective	

	communicate in appropriate ways if teachers make a deliberate effort to encourage them to do so. These social and emotional skills are essential for learners' development. They support effective learning and are linked to positive outcomes in later life. Social and emotional learning can enhance mental health and well-being, positive learner behaviour and academic performance. LO 1: Demonstrate knowledge and understanding of concepts related to SEL (NTS 2e, 2f, 3c, 3d, 3f, 3g and 3k). LI 1.1 Explain the term SEL. LI 1.2 List and explain at least three competencies associated with SEL. LO 2: Demonstrate knowledge, understanding and application of SEL across the SHS/TVET curriculum (NTS 2e, 2f, 3c, 3d, 3f, 3g and 3k). LI 2.1 Mention and explain at least two benefits of SEL competencies. LI 2.2 Discuss how to promote SEL competencies in the school environment including the classroom.	and communicate in appropriate ways if teachers make a deliberate effort to encourage them to do so. These social and emotional skills are essential for learners' development. They support effective learning and are linked to positive outcomes in later life. Social and emotional learning can enhance mental health and well-being, positive learner behaviour and academic performance. LO 1: Demonstrate knowledge and understanding of concepts related to SEL (NTS 2e, 2f, 3c, 3d, 3f, 3g and 3k). LI 1.1 Explain the term SEL. LI 1.2 List and explain at least three competencies associated with SEL. LO 2: Demonstrate knowledge, understanding and application of SEL across the SHS/TVET curriculum (NTS 2e, 2f, 3c, 3d, 3f, 3g and 3k). LI 2.1 Mention and explain at least two benefits of SEL competencies. LI 2.2 Discuss how to promote SEL competencies in the school environment including the classroom.	

	2.2 Ask teachers in pairs/groups to explain the term SEL in their own words (NTS 2c, 2e). *Note:* *Refer to the introduction* 2.3 Ask teachers to list and explain at least three competencies associated with SEL (NTS 2e, 2f). *E.g.* *a) Self-awareness: Ability to consider and understand one's emotions, thoughts, values and experiences, and how these can influence one's actions* *b) Self-management: Ability to regulate and control one's emotions, thoughts and behaviours* *c) Responsible decision making: Ability to make positive and constructive choices based on ethical standards, safety concerns and social norms* *d) Social awareness: Ability to empathise with others and treat them fairly* *e) Relationship skills: Ability to make positive connections with others, taking their emotions into account, etc.* 2.4 Ask teachers in pairs/groups to mention and explain at least two benefits of any of the competencies of SEL (NTS 2e, 2f, 3c, 3f, 3g, 3k and 3l).	2.2 In pairs/groups, explain the term SEL in your own words (NTS 2c, 2e). 2.3 List and explain at least three competencies associated with SEL (NTS 2e, 2f). *E.g.* *Self-awareness: Ability to consider and understand one's emotions, thoughts, values and experiences, and how these can influence one's actions, etc.* 2.4 In pairs/groups, mention and explain at least two benefits of any of the competencies of SEL (NTS 2e, 2f, 3c, 3f, 3g, 3k and 3l).	

	E. g. *a) Self-awareness:* *i. Helps to identify one's strengths and limitations* *ii. Improves self-management and decision making* *b) Self-management:* *i. Helps to control one's impulses* *ii. Helps one to set goals and cultivate self-discipline* *c) Responsible decision making:* *Helps one to make positive choices and avoid negative ones* *d) Social awareness:* *Helps one to establish and maintain healthy relationships and social interactions* *e) Relationship skills:* *Helps one to establish and maintain healthy, mutually rewarding relationships, etc.* 2.5 Ask teachers to discuss how they will promote SEL competencies in their classroom and the school as a whole (NTS 3c). *E. g.* *a) Self-awareness:* *Expand learners' emotional vocabulary and support them to express emotions* *b) Self-management:* *i. Encourage learners to use self-calming strategies and positive self-talk to help deal with intense emotions*	*E.g.* *Self-awareness:* *Helps to identify one's strengths and limitations, etc.* 2.5 Discuss how you will promote SEL competencies in your classroom and the school as a whole (NTS 3c). *E.g.* *Self-awareness:* *Expand learners' emotional vocabulary and support them to express emotions, etc.*	

	ii. Model the social and emotional behaviour you want learners to emulate *c) Social awareness:* *i. Use stories to discuss others' emotions and perspectives* *ii. Give specific and focused praise when learners display SEL skills* *d) Relationship skills: Role play good communication and listening skills* *e) Responsible decision-making:* *i. Get learners to practise problem solving strategies* *ii. Embed SEL in teaching across a range of subject areas (literacy, history, drama and PE), etc.* 2.6 Ask teachers to reflect individually, share their ideas with a colleague and then with the larger group (i.e. think-pair-share) to identify possible barriers to applying concepts of SEL to teaching and learning and how to address them (NTS 2f, 3m). *E.g.* *Misconceptions:* *a) Many people think that reserved and shy learners are academically weak* *To address this, teachers can use whole-class dialogue, questions,*	2.6 Reflect individually, share your ideas with a colleague and then with the larger group (i.e. think-pair share) possible barriers to applying concepts of SEL to teaching and learning and how to address them (NTS 2f, 3m). *E.g.* *Misconception:* *Many people think that reserved and shy learners are academically weak, etc.* *To address this, teachers can use whole-class dialogue,*	

	think-pair-share in their lessons which will encourage reserved learners to participate fully in lessons b) *Friendship between boys and girls in school is misconstrued as sexual relationship* *To address this, learners should be educated on healthy gender relationships, etc.* 2.7 Ask teachers to identify at least four ways of making assessment SEL responsive (NTS 3k, 3n - 3p). *E.g.* a) *Provide constructive feedback to all learners* b) *Give male and female learners equal opportunity to ask and answer questions* c) *Use self and peer assessment activities* d) *Use differentiated assessment to cater for different learning needs of learners* e) *Respect and appreciate learners' feedback, etc.* 2.8 Ask teachers to write and share at least four SEL responsive practices that can help make the learning environment conducive and non-threatening (NTS 3a -3c, 3e - 3g).	*questions, think-pair-share in their lesson which will encourage reserved learners to participate fully in lessons, etc.* 2.7 Identify at least four ways of making assessment SEL responsive (NTS 3k, 3n - 3p). *E.g.* *Provide constructive feedback to all learners, etc.* 2.8 Write and share at least four SEL responsive practices that can help make the learning environment conducive and non-threatening (NTS 3a -3c, 3e - 3g).	

	E.g. *a) Provide suitable seating arrangement to meet all types of learners' needs* *b) Avoid negative expressions or language that can demean or exclude learners* *c) Avoid labelling learners based on their background and physical appearance* *d) Assign roles fairly to all learners* *e) Respect learners' views at all times* *f) Identify/call learners by their official names* *g) Provide psychological safety that makes the learning environment non-threatening, etc.* *Refer to Appendix 3 for a sample lesson plan in social studies*	*E.g.* *Provide suitable seating arrangements to meet all types of learners' needs, etc.* *Refer to Appendix 3 for a sample lesson plan in social studies*	
3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	3.1 Ask teachers to identify in the sample lesson plan, activities that could promote SEL, GESI, ICT, 21st century skills and differentiation (NTS 3c, 3e - 3g). *E.g.* *a) Learners were encouraged to say positive things about their colleagues (SEL, 21st century skills)* *b) Mixed-ability and mixed-gender groups were used in the lesson (GESI/Differentiation)* *c) Teacher used all-inclusive class discussion (GESI/*	3.1 Identify in the sample lesson plan, activities that could promote SEL, GESI, ICT, 21st century skills and differentiation (NTS 3c, 3e - 3g). *E.g.* *Learners were encouraged to say positive things about their colleagues (SEL, 21st century skills), etc.*	30 mins

	SEL/21st century skills) d) *Teacher identified learners by their official names making reference to the class list (SEL)* e) *Conscious effort was made to encourage those who were reserved to contribute to discussions (SEL)* f) *Leaders were elected by learners during group work (21st Century)* g) *PowerPoint were used in presentation (ICT)* h) *Appropriate praises were given to complement learners' efforts (SEL/Differentiation)* i) *Teacher moved around the class to encourage and support all learners (GESI/SEL/ Differentiation)* j) *Learners were reminded to be guarded in their comments while the teacher intervened to correct unguarded remarks(SEL)* 3.2 Ask teachers to recommend other appropriate assessment strategies that are SEL responsive (NTS 1a, 2e, 3f and 3m). *E.g.* a) *Peer assessment*	3.2 Recommend other appropriate assessment strategies that are SEL responsive (NTS 1a, 2e, 3f and 3m). *E.g.* *Peer assessment, etc.*	

	b) Self-assessment, *c) Using games* *d) Riddles, etc.* 3.3 Ask teachers to suggest two ways in which ICT can be used in promoting SEL during lessons (NTS 3j). *E.g.* *a) Using print material/pictures that depict friendliness, collaboration and inclusiveness* *b) Using YouTube videos that show empathy, support, self-management* *c) Using virtual games that have motivational feedback embedded, etc.* 3.4 Ask a teacher to model a teaching activity based on the sample lesson plan that can support learners who may struggle identifying the steps that can be taken to reduce environmental degradation at the appropriate level, taking into consideration SEL, GESI, ICT, 21st century skills and differentiation (NTS 1a, 2c). 3.5 Ask teachers to provide feedback on the lesson delivered (NTS 3n, 3o).	3.3 Suggest two ways in which ICT can be used in promoting SEL during lessons (NTS 3j). *E.g.* *Using print material/pictures that depict friendliness, collaboration and inclusiveness, etc.* 3.4 Model a teaching activity based on the sample lesson plan that can support learners who may struggle identifying the steps that can be taken to reduce environmental degradation at the appropriate level, taking into consideration SEL, GESI, ICT, 21st century skills and differentiation (NTS 1a, 2c). 3.5 Provide feedback on the lesson delivered (NTS 3n, 3o).	
4. Evaluation and review of session: ● **Noting that teachers need to identify**	4.1 Ask teachers in groups to reflect, write and share what they have learned with the larger group with regard to the concept, benefits and application of SEL in the	4.1 In your group, reflect, write and share what you have learned with the larger group with regard to the concept, benefits and application of SEL in the	10 mins

colleagues to observe lessons and report at the next session	school environment (NTS 1a, 1b). 4.2 Remind teachers to, where possible, identify a critical friend to observe their lesson and provide feedback to them on how they have used SEL in their lesson (NTS 1a, 3l and 3n). 4.3 Remind teachers to read PLC Session 4 in preparation for the next session.	school environment (NTS 1a, 1b). 4.2 Where possible, identify a critical friend to observe your lesson and provide feedback to you on how you have used SEL in your lesson. (NTS 1a, 3l and 3n). 4.3 Read PLC Session 4 in preparation for the next session.	
Appendix 3	*Sample lesson plan based on Social Studies SHS Three 2010 Syllabus* *a) Topic: Environmental challenges* *b) Sub-Topic: Environmental degradation* *c) Objectives: By the end of the lesson, the learner will be able to:* *i. Describe at least three activities that degrade the environment* *ii. Describe at least three effects of degradational activities on human life* *iii. Identify at least three steps that can be taken to reduce environmental degradation* *d) Teaching and Learning Resources (TLRs): Computer, projector, pictures,*	*Sample lesson plan based on Social Studies SHS Three 2010 Syllabus* *a) Topic: Environmental challenges* *b) Sub-Topic: Environmental degradation* *c) Objectives: By the end of the lesson, the learner will be able to:* *i. Describe at least three activities that degrade the environment* *ii. Describe at least three effects of degradational activities on human life* *iii. Identify at least three steps that can be taken to reduce environmental degradation* *d) Teaching and Learning Resources (TLRs): Computer, projector, pictures,*	

	flipcharts/cardboards etc. *e) Relevant Previous Knowledge (RPK): Learners can mention the components of the environment.* *f) Introduction:* *i. Ask learners to count the number of colleagues in the class from wherever they sit in the classroom and write the number down. Call some of the learners to tell you any number they like between one and the number they have written down. For each number that a learner mentions, refer to your class list and mention the name of the learner that corresponds to that number and ask the learner who chose that number to say something positive about the colleague whose name was mentioned.* *ii. In an all-inclusive class discussion, guide learners to mention the components of the environment. Make conscious effort to encourage those who are reserved to contribute to the discussion.*	*flipcharts/cardboards etc.* *e) Relevant Previous Knowledge (RPK): Learners can mention the components of the environment.* *f) Introduction:* *i. Ask learners to count the number of colleagues in the class from wherever they sit in the classroom and write the number down. Call some of the learners to tell you any number they like between one and the number they have written down. For each number that a learner mentions, refer to your class list and mention the name of the learner that corresponds to that number and ask the learner who chose that number to say something positive about the colleague whose name was mentioned.* *ii. In an all-inclusive class discussion, guide learners to mention the components of the environment. Make conscious effort to encourage those who are reserved to contribute to the discussion.*	

	g) Task/Activities: *i. Ask learners to form mixed-gender/mixed-ability groups of three to five learners (consider class size). In each group let them elect a leader and a secretary. Show PowerPoint slides of some activities that degrade the environment for them to observe and discuss. Call each group to pick any of the activities and describe how it contributes to environmental degradation. Provide appropriate measure of praise for effort.* *ii. Guide learners in groups to discuss the effects of environmental degradation. Each group should be given a flip-chart /card board to write their findings and appoint among themselves one to present their points in class.* *iii. Ask learners in groups to identify themselves as political parties with their own names (Let them use non-existent names). Let them discuss and prepare a manifesto*	*g) Task/Activities:* *i. Ask learners to form mixed-gender/mixed-ability groups of three to five learners (consider class size). In each group let them elect a leader and a secretary. Show PowerPoint slides of some activities that degrade the environment for them to observe and discuss. Call each group to pick any of the activities and describe how it contributes to environmental degradation. Provide appropriate measure of praise for effort.* *ii. Guide learners in groups to discuss the effects of environmental degradation. Each group should be given a flip-chart /card board to write their findings and appoint among themselves one to present their points in class.* *iii. Ask learners in groups to identify themselves as political parties with their own names (Let them use non-existent names). Let them discuss and*	

	on steps that they would take to reduce the degradation of the environment if they are elected. Move round the groups to encourage and support them appropriately. *iv. Ask the groups to present their manifestoes using media as appropriate and ask learners to critique them. Remind learners to be guarded in their comments and intervene to correct unguarded remarks.* *h) Core Points:* *i. Activities that degrade the environment:* ➢ *Bush burning* ➢ *Deforestation* ➢ *Sand winning* ➢ *Improper mining practices* ➢ *Improper disposal of refuse* *ii. Effects of environmental degradation:* ➢ *Diseases* ➢ *Destruction of plant and animal life* ➢ *Floods* ➢ *Occupational and industrial accidents*	*prepare a manifesto on steps that they would take to reduce the degradation of the environment if they are elected. Move round the groups to encourage and support them appropriately.* *iv. Ask the groups to present their manifestoes using media as appropriate and ask learners to critique them. Remind learners to be guarded in their comments and intervene to correct unguarded remarks.* *h) Core Points:* *i. Activities that degrade the environment:* ➢ *Bush burning* ➢ *Deforestation* ➢ *Sand winning* ➢ *Improper mining practices* ➢ *Improper disposal of refuse* *ii. Effects of environmental degradation:* ➢ *Diseases* ➢ *Destruction of plant and animal life* ➢ *Floods* ➢ *Occupational and industrial accidents*	

	➢ *Global warming* *iii. Steps to reduce environmental degradation:* ➢ *Sanctions should be imposed on offenders* ➢ *Public education* ➢ *National policy to protect the environment* ➢ *Appropriate technology usage* *i) Core Competencies:* *i. Digital literacy* *ii. Problem solving skills* *iii. Collaboration skills* *iv. Critical thinking skills* *v. Personal development* *j) Conclusion:* *Review lesson with learners by asking them in their various groups to summarise what they learned. Commend learners for their participation.* *k) Evaluation:* *i. Class Exercise* ➢ *Describe at least three activities that degrade the environment* ➢ *Describe at least three effects of degradational activities on human life*	➢ *Global warming* *iii. Steps to reduce environmental degradation:* ➢ *Sanctions should be imposed on offenders* ➢ *Public education* ➢ *National policy to protect the environment* ➢ *Appropriate technology usage* *i) Core Competencies:* *i. Digital literacy* *ii. Problem solving skills* *iii. Collaboration skills* *iv. Critical thinking skills* *v. Personal development* *j) Conclusion:* *Review lesson with learners by asking them in their various groups to summarise what they learned. Commend learners for their participation.* *k) Evaluation:* *i. Class Exercise* ➢ *Describe at least three activities that degrade the environment* ➢ *Describe at least three effects of degradational activities on human life*	

	➢ *Identify at least three steps that can be taken to reduce environmental degradation* *ii. Assignment:* *Write an article on the topic "solving environmental degradation problems in my community" for publication in the Junior Graphic.* *iii. Group Project* *In your groups, identify an environmental challenge in the school. Plan strategies for solving it, implement the strategy and present your report using varied media at the end of the term.* *l) Remarks:*	➢ *Identify at least three steps that can be taken to reduce environmental degradation* *ii. Assignment:* *Write an article on the topic "solving environmental degradation problems in my community" for publication in the Junior Graphic.* *iii. Group Project* *In your groups, identify an environmental challenge in the school. Plan strategies for solving it, implement the strategy and present your report using varied media at the end of the term.* *l) Remarks:*	

PLC Session 4: The concept and importance of numeracy across the curriculum			
Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do and say during each session. Each bullet needs to be addressed	**Guidance notes on Leading the session.** *What the PLC Coordinator will have to say during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking teachers to share what they did differently in the classroom or elsewhere based on PLC Session 3, on *social and emotional learning (SEL)*, which they think impacted learning positively. 1.2 Ask teachers to discuss and summarise in a single sentence, why they think what their colleague did by way of application of what they learned in Session 3, on *social and emotional learning (SEL)*, supported teaching and learning.	1.1 Share what you did differently in the classroom or elsewhere based on PLC Session 3, on *social and emotional learning (SEL),* which you think impacted learning positively. 1.2 Discuss and summarise in a single sentence, why you think what a colleague did by way of application of what you learned in Session 3, on *social and emotional learning (SEL)*, supported teaching and learning.	20 mins
2. Planning for teaching, learning and assessment activities, making links with the Pre-	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	30 mins

Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	**Purpose:** The purpose of the session is to discuss the concept and importance of numeracy across the SHS/TVET curriculum. LO 1: Demonstrate knowledge, understanding and application of the concept of numeracy across SHS/TVET curriculum (NTS 2c - 2f, 3f, 3g and 3i). LI 1.1 Explain the concept of numeracy across the SHS/TVET curriculum. LI 1.2 Discuss the likely challenges of integrating numeracy across the SHS/TVET curriculum. LO 2: Demonstrate knowledge and understanding of the importance of numeracy across the SHS/TVET curriculum (NTS 2c - 2f, 3f, 3g and 3i). LI 2.1 Discuss the strategies for integrating numeracy at the right level across the SHS/TVET curriculum. LI 2.2 Analyse at least two benefits of integrating numeracy at the right level across the SHS/TVET curriculum. 2.2 Ask teachers in pairs to explain to their partners and share with the larger group the concept of numeracy across the	**Purpose:** The purpose of the session is to discuss the concept and importance of numeracy across the SHS/TVET curriculum. LO 1: Demonstrate knowledge, understanding and application of the concept of numeracy across the SHS/TVET curriculum (NTS 2c - 2f, 3f, 3g and 3i). LI 1.1 Explain the concept of numeracy across the SHS/TVET curriculum. LI 1.2 Discuss the likely challenges of integrating numeracy across the SHS/TVET curriculum. LO 2: Demonstrate knowledge and understanding of the importance of numeracy across the SHS/TVET curriculum (NTS 2c - 2f, 3f, 3g and 3i). LI 2.1 Discuss the strategies for integrating numeracy at the right level across the SHS/TVET curriculum. LI 2.2 Analyse at least two benefits of integrating numeracy at the right level across the SHS/TVET curriculum. 2.2 In pairs, explain to your partner and share with the larger group the concept of numeracy across the SHS/TVET curriculum (NTS 2c, 3i).	

	SHS/TVET curriculum (NTS 2c, 3i). *E.g.* *Numeracy is the knowledge, skills and ability to recognise, understand and apply mathematical concepts in solving problems in all areas of life. Mathematics is a tool used in finding answers to questions and problems, which arise in everyday life, trades and profession (Paling, 1982). Different subject learners need to understand how different mathematical concepts might be applied in different situations. The integration of numeracy will improve learners' ability to relate numeracy skills to other subjects and topics effectively and appropriately* 2.3 Ask teachers to discuss at least three likely challenges of integrating numeracy across the SHS/TVET curriculum (NTS 2b, 2c). *E.g.* *a) The tendency to focus on teaching mathematics instead of its application* *b) Focusing on numeracy simply as numbers and not recognising*	*E.g.* *Numeracy is the knowledge, skills and ability to recognise, understand and apply mathematical concepts in solving problems in all areas of life. Mathematics is a tool used in finding answers to questions and problems, which arise in everyday life, trades and profession (Paling, 1982). Different subject learners need to understand how different mathematical concepts might be applied in different situations. The integration of numeracy will improve learners' ability to relate numeracy skills to other subjects and topics effectively and appropriately* 2.3 Discuss at least three likely challenges of integrating numeracy across the SHS/TVET curriculum (NTS 2b, 2c). *E.g.* *The tendency to focus on teaching mathematics instead of its application, etc.*	

	patterns and making sense of information *c) Lack of numeracy skills or strategies on the part of teachers prohibits them from applying these skills appropriately* *d) The teacher's inability to develop numeracy skills within a lesson, etc.* 2.4. Ask teachers to discuss the strategies for integrating numeracy at the right level across the SHS/TVET curriculum (NTS 2c - 2f, 3a, 3e, and 3g). *E.g.* *a) Identifying opportunities for using mathematical concepts such as data collection, number, addition, subtraction and measurement of time in other subjects* *b) Giving remediation to learners with challenges in numeracy* *c) Using mathematical concepts to solve problems in other subject areas such as science, business management, economics, food and nutrition, etc.* *d) Building cross-curricula links to*	2.4. Discuss the strategies for integrating numeracy at the right level across the SHS/TVET curriculum (NTS 2c - 2f, 3a, 3e, and 3g). *E.g.* *Identifying opportunities for using mathematical concepts such as data collection in other subjects, etc.*	

	bridge the gaps between subjects *e) Developing activities that will enable learners to recognise patterns and make sense of information knowing that numeracy is not simply about numbers* *f) Having clear teaching goals that include numeracy objectives* *g) Encouraging children to spot opportunities to practise their numeracy skills, etc.* 2.5 Ask teachers to discuss at least three benefits of numeracy when used at the right level across the SHS/TVET curriculum (NTS 2c, 2d). *E.g.* *a) It enhances the understanding of concepts in numeracy related subjects. The more numerate a learner is, the more likely they are to contribute meaningfully to the learning of mathematics related subjects* *b) It takes some of the fear and stress away from learning mathematics*	2.5 Discuss at least three benefits of numeracy when used at the right level across the SHS/TVET curriculum (NTS 2c, 2d). *E.g.* *It enhances the understanding of concepts in numeracy related subjects. The more numerate a learner is, the more likely they are to contribute meaningfully to the learning of mathematics related subjects, etc.*	

	making it more enjoyable *c) It helps learners to develop appropriate mathematics skills in various disciplines in their academic work* *d) Learner's academic success to a large extent depends on how proficient they are in numeracy* *e) Numeracy helps to equip learners to develop transferable skills (critical thinking, collaboration, observation, enquiry skills and digital literacy, etc.)* *f) Numeracy concepts help learners to make sense of their world and connect these concepts with their environments and everyday activities such as telling time, reading maps, cooking and setting tables, etc.* 2.6 Ask teachers to discuss a sample lesson plan in their subject areas and show how it can be taught with the support of numeracy for learners who may struggle with numbers and computational skills (NTS 3e – 3m). *Refer to Appendix 4 for a sample lesson plan in business studies for learners*	2.6 Discuss a sample lesson plan in your subject area and show how it can be taught with the support of numeracy for learners who may struggle with numbers and computational skills (NTS 3e – 3m). *Refer to Appendix 4 for a sample lesson plan in business studies for learners*	

3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	3.1 Ask teachers to identify in the sample lesson plan, activities that could promote, GESI, SEL, ICT, 21st century skills and differentiation (NTS 3a-3c, 3e-3g). *E.g.* *a) Teacher used mixed-ability and mixed-gender groupings during role play in teaching population census (GESI/21st century skills /Differentiation)* *b) Teacher gave positive feedback to all learners especially SEN learners (GESI/SEL)* *c) Teacher assigned differentiated tasks to learners (Differentiation)* *d) Learners grouped themselves into households through self-awareness and interests (SEL)* *e) Teacher provided one-on-one support to learners who struggled with enumerating demographic characteristics (SEL/ICT)* 3.2 Ask teachers to discuss how the lesson plan is linked to the use of formative assessment tools	3.1 Identify in the sample lesson plan, activities that could promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3a-3c, 3e-3g). *E.g.* *Teacher used mixed-ability and mixed-gender groupings during role play in teaching population census, etc.* 3.2 Discuss how the lesson plan is linked to the use of formative assessment tools (assessment 'as' and	30 mins

	(assessment 'as' and assessment 'for') and practices (NTS 3k - 3m). *E.g.* *a) Assessment 'as': Giving self-reflective and problem-posing class exercises based on population census terms* *b) Assessment 'for': Learners in groups, work on more examples on population census and get feedback from their peers*	assessment 'for') and practices (NTS 3k - 3m). *E.g.* *Assessment 'as': Giving self-reflective and problem-posing class exercises based on population census terms, etc.*	
	3.3 Ask teachers to recommend other appropriate assessment strategies that could aid in the development of numeracy skills in learners who may have weak number sense and computational skills (NTS 1a, 2e, 3f, 3k and 3m). *E.g.* *a) Mental activities* *b) Peer teaching* *c) Self-practice* *d) Presentation, etc.*	3.3 Recommend other appropriate assessment strategies that could aid in the development of numeracy skills in learners who may have weak number sense and computational skills (NTS 1a, 2e, 3f, 3k and 3m). *E.g.* *Mental activities, etc.*	15 mins
	3.4 Ask teachers to explain how ICT can be used in assessing learners of different abilities in business studies (NTS 3j). *E.g.* *a) Watching YouTube/Pre-recorded videos and podcast and writing a report on the conduct of population census*	3.4 Explain how ICT can be used in assessing learners of different abilities in business studies (NTS 3j). *E.g.* *Watching YouTube/Pre-recorded videos and podcast and writing a report on the conduct of population census, etc.*	

	b) Giving learners assignments that would involve numeracy on household census to be presented in PowerPoint *c) Giving learners projects to search online for information* *d) Using google forms to quiz learners, etc.* 3.5 Ask a teacher to model a teaching activity based on the sample lesson plan that can support learners who may have weak number sense and computational skills in the lesson taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 1b). 3.6 Ask teachers to give feedback on the lesson delivered (NTS 1a, 2c).	 3.5 Model a teaching activity based on the sample lesson plan that can support learners who may have weak number sense and computational skills in the lesson taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 1b). 3.6 Give feedback on the lesson delivered (NTS 1a, 2c).	
4. Evaluation and review of session: ➢ **Noting that teachers need to identify critical friends to observe lessons and report at next session**	4.1 Ask teachers in groups to reflect, write and share what they have learned with the larger group with regard to the concept and benefits of numeracy across the SHS/TVET curriculum (NTS 1a, 1b). 4.2 Remind teachers to, where possible, identify a critical friend to observe their lesson in relation to PLC Session 4 and provide feedback to them (NTS 3l, 3n and 3o).	4.1 In your group, reflect, write and share what you have learned with the larger group with regard to the concept and benefits of numeracy across the SHS/TVET curriculum (NTS 1a, 1b). 4.2 Where possible, identify a critical friend to observe your lesson in relation to PLC Session 4 and provide feedback to you (NTS 3l, 3n and 3o).	10 mins

	4.3 Remind teachers to read PLC Session 5 in preparation for the next session.	4.3 Read PLC Session 5 in preparation for the next session.	
Appendix 4	*A sample lesson plan for teaching population census to learners in SHS 2:* *a) Topic: Population* *b) Sub-topic: Population Census* *c) Objectives: By the end of the lesson, the learner will be able to:* *i. Enumerate a household size of a population* *ii. Take class census based on at least three demographic characteristics of a population* *d) Teaching and Learning Resources (TLRs): Posters (household picture), calculator, computer and projector* *e) Relevant Previous Knowledge (RPK): Learners identify colleagues in their dormitory with respect to their various levels.* *f) Introduction: Ask learners to mention the numbers of SHS1, SHS2 and SHS3 students in their various dormitories (boarding students) or the numbers of males and females in their various homes (day students).* *g) Tasks/Activities:*	*A sample lesson plan for teaching population census to learners in SHS 2:* *a) Topic: Population* *b) Sub-topic: Population Census* *c) Objectives: By the end of the lesson, the learner will be able to:* *i. Enumerate a household size of a population* *ii. Take class census based on at least three demographic characteristics of a population* *d) Teaching and Learning Resources (TLRs): Posters (household picture), calculator, computer and projector* *e) Relevant Previous Knowledge (RPK): Learners identify colleagues in their dormitory with respect to their various levels.* *f) Introduction: Ask learners to mention the numbers of SHS1, SHS2 and SHS3 students in their various dormitories (boarding students) or the numbers of males and females in their various homes (day students).* *g) Tasks/Activities:*	

	i. *Show a poster of a household to learners and let them discuss the approximate ages of the household members.* ii. *Guide learners in mixed-ability groups, representing a household, to prepare a questionnaire for a census in the class.* iii. *Ask learners to nominate two of their group members (male and female) as census enumerators to count and record each member of a household in terms of age, sex, level of education, etc.* iv. *Guide learners to represent their records in tables and/or charts (They may use the Excel Spreadsheet), e.g. bar chart* v. *Ask all groups to post their work on the walls for gallery walk and project the bar chart of one group for appreciation.* vi. *Identify individuals who have challenges in numeracy skills and give remediation.*	i. *Show a poster of a household to learners and let them discuss the approximate ages of the household members.* ii. *Guide learners in mixed-ability groups, representing a household, to prepare a questionnaire for a census in the class.* iii. *Ask learners to nominate two of their group members (male and female) as census enumerators to count and record each member of a household in terms of age, sex, level of education, etc.* iv. *Guide learners to represent their records in tables and/or charts, e.g. bar chart.* v. *Ask all groups to post their work on the walls for gallery walk and project the bar chart of one group on the wall for appreciation.* vi. *Identify individuals who have challenges in numeracy skills and give remediation.*	

	h) Core points: *i. Population census is the official headcount and the collection of data on various characteristics of the population of all residents in a particular area over a given period of time, usually every ten years.* *ii. Population size is the total number of people in a defined geographical area at a particular time.* *iii. A census involves preparation, implementation and data processing stages.* *iv. Demographic characteristics of a population include name, age, sex, height, occupation, etc.* *i) Core competencies:* *i. Critical thinking and problem-solving skills* *ii. Numeracy skills* *iii. Communication and Collaborative skills* *iv. Innovation and creativity* *v. Cultural identity and global citizenship* *vi. Leadership skills*	*h) Core points:* *i. Population census is the official headcount and the collection of data on various characteristics of the population of all residents in a particular area over a given period of time, usually every ten years.* *ii. Population size is the total number of people in a defined geographical area at a particular time.* *iii. A census involves preparation, implementation and data processing stages.* *iv. Demographic characteristics of a population include name, age, sex, height, occupation, etc.* *i) Core competencies:* *i. Critical thinking and problem-solving skills* *ii. Numeracy skills* *iii. Communication and Collaborative skills* *iv. Innovation and creativity* *v. Cultural identity and global citizenship* *vi. Leadership skills*	

	j) Conclusion: *Ask the various groups to come out with what they have learnt from the lesson and how they intend to apply it at home.* *k) Evaluation:* *Project work: Find the total population of male and female students in any three selected programmes of your choice in the school taking into consideration their age range, month of birth and any other demographic characteristics.* *l) Remarks:*	*j) Conclusion:* *Ask the various groups to come out with what they have learnt from the lesson and how they intend to apply it at home.* *k) Evaluation:* *Project work: Find the total population of male and female students in any three selected programmes of your choice in the school taking into consideration their age range, month of birth and any other demographic characteristics.* *l) Remarks:*	

PLC Session 5: Supporting the teaching and learning of numeracy at the right level in Information and Communication Technology (ICT)			
Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do and say during each session. Each bullet needs to be addressed	**Guidance notes on Leading the session.** *What the PLC Coordinator will have to say during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking teachers to share what they did differently in the classroom or elsewhere based on PLC Session 4, on *the concept and importance of numeracy across the secondary school curriculum*, which they think impacted learning positively. 1.2 Ask teachers to discuss and summarise in a single sentence, why they think what a colleague did by way of application of what they learned in Session 4, on *the concept and importance of*	1.1 Share what you did differently in the classroom or elsewhere based on PLC Session 4, on *the concept and importance of numeracy across the secondary school curriculum,* which you think impacted learning positively. 1.2 Discuss and summarise in a single sentence, why you think what a colleague did by way of application of what they learned in Session 4, on *the concept and importance of numeracy across*	20 mins

	numeracy across the secondary school curriculum, supported learning.	*the secondary school curriculum*, supported learning.	
2. Planning for teaching, learning and assessment activities, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session. **Purpose:** The purpose of the session is to discuss how to support the teaching and learning of numeracy at the right level in Information and Communication Technology (ICT), and vice versa. LO 1: Demonstrate knowledge, understanding and application of the use of numeracy to support the teaching and learning of ICT (NTS 2b - 2d, 3j). LI 1.1 Identify areas in numeracy that can support the teaching and learning of ICT. LI 1.2 Explain how the areas in numeracy can be applied in the teaching and learning of ICT. LO 2: Demonstrate knowledge, understanding and application of using ICT to support the development of numeracy (NTS 2c - 2e, 3j). LI 2.1 Identify ICT tools that can support the development of numeracy. LI 2.2 Describe how ICT tools can be applied in the development of numeracy. 2.2 Ask teachers in pairs to identify areas in numeracy that can support the teaching and	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session. **Purpose:** The purpose of the session is to discuss how to support the teaching and learning of numeracy at the right level in Information and Communication Technology (ICT), and vice versa. LO 1: Demonstrate knowledge, understanding and application of the use of numeracy to support the teaching and learning of ICT (NTS 2b - 2d, 3j). LI 1.1 Identify areas in numeracy that can support the teaching and learning of ICT. LI 1.2 Explain how the areas in numeracy can be applied in the teaching and learning of ICT. LO 2: Demonstrate knowledge, understanding and application of using ICT to support the development of numeracy (NTS 2c - 2e, 3j). LI 2.1 Identify ICT tools that can support the development of numeracy. LI 2.2 Describe how ICT tools can be applied in the development of numeracy. 2.2 Identify areas in numeracy that can support the teaching	30 mins

	learning of ICT (NTS 2b - 2d, 3h and 3j). *E.g.* *a) Arithmetic operations* *b) numeration* *c) Seriation* *d) Mensuration* *e) Representation* *f) Geometry, etc.* 2.3 Ask teachers to explain how areas in numeracy can be applied in the teaching and learning of ICT (NTS 3d, 3i and 3j). *E.g.* *a) Arithmetic operations: Operations symbols (+,×, ÷, -, =, etc.) could be used to create formulae in spreadsheets* *b) Numeration: Counting, tallying, numbering, etc., could be used in the entry of data* *c) Seriation: Arranging data or objects in a specific order such as size, position and location could be used in graphic designing and data analysis* *d) Mensuration: Measurement could be used to take lengths of ICT tools, format word documents, plot diagrams/charts and quantify data* *e) Representation: Various forms of mathematical representation (graphs,*	and learning of ICT (NTS 2b - 2d, 3h and 3j). *E.g.* *Arithmetic operations, etc.* 2.3 Explain how areas in numeracy can be applied in the teaching and learning of ICT (NTS 3d, 3i and 3j). *E.g.* *Arithmetic operations: Operations symbols (+, ×, etc.) could be used to create formulae in spreadsheets, etc.*	

	patterns, etc.) can be used to display data, etc. 2.4 Ask teachers to identify ICT tools that can support the development of numeracy (NTS 2c - 2e, 3a, 3e and 3j). *E.g.* *a) ICT Devices:* *i. Calculator* *ii. Smartphones* *iii. Laptop/Desktop* *iv. Projectors* *v. Charts* *vi. Smartboards* *vii. Braille, etc.* *b) ICT Applications:* *i. Spreadsheets* *ii. Microsoft maths solver* *iii. Photomath* *iv. Malmath* *v. Math CAD* *vi. Graphmatica* *vii. Math editor* *viii. Geometry pad, etc.* *2.5* Ask teachers to describe how ICT concepts and tools can be applied in the development of numeracy (NTS 2c - 2e, 3a, 3e and 3j). *E.g.* *a) Spreadsheets:* *They can be used as a mathematical tool for calculations and graphical representations* *b) Photomath:* *It is a quick mathematical solution application tool that gives a step by step*	2.4 Identify ICT tools that can support the development of numeracy (NTS 2c - 2e, 3a, 3e and 3j). *E.g.* *a) ICT Devices:* *Calculator, etc.* *b) ICT Applications:* *Spreadsheets, etc.* *2.5* Describe how ICT concepts and tools can be applied in the development of numeracy (NTS 2c - 2e, 3a, 3e and 3j). *E.g.* *Spreadsheets:* *They can be used as a mathematical tool for calculations and graphical representations, etc.*	

	solution to a maths problem that has been scanned on it. This can support the learning of numeracy at learner's own pace c) *Geometry pad:* *This mathematical application will help the learner to practise vital constructions. It is a learner friendly tool that helps in the presentation of geometric constructions, taking measurements, compass use and experimentation of different geometric shapes in an easier manner* d) *Malmath:* *It is a maths problem solver that supports learners with step by step description and analysis of graph. It works online and offline* e) *Microsoft mathematics solver:* *The application is used to help learners solve complicated maths problems in a step by step manner. It has graphing calculator, unit convertor, and equation and triangle solver, etc. that can support the development of numeracy in learners, etc.* 2.6 Ask teachers to discuss the sample lesson plan in ICT and	2.6 Discuss the sample lesson plan in ICT and show how it can	

	show how it can be taught to help develop numeracy in learners (NTS 3e - 3l).	be taught to help develop numeracy in learners (NTS 3e - 3l).	
	Refer to Appendix 5 for a sample lesson plan in ICT 2.7 Ask teachers to indicate how the lesson will be assessed using other appropriate methods. *E.g.* *a) Number riddles* *b) Maths quiz* *c) Maths projects* *d) Partner/Peer quizzes* *e) Self-assessment, etc.*	*Refer to Appendix 5 for a sample lesson plan in ICT* 2.7 Indicate how the lesson will be assessed using other appropriate methods. *E.g.* *Number riddles, etc.*	
3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	3.1 Ask teachers to identify in the sample lesson plan, activities that could promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3c, 3e - 3g). *E.g.* *a) Mixed-ability groups were used in the lesson (GESI/ SEL/21st century skills)* *b) Soft ball was used as a game to select groups to participate in class activities (SEL/21st century skills)* *c) Learners were encouraged to support each other to perform tasks on their computers (GESI/SEL/ICT)* *d) Teacher moved around the class to encourage the participation of learners with diverse abilities to construct spreadsheets (ICT/GESI/SEL)* *e) Learners were encouraged to respect the views of others (GESI/SEL)*	3.1 Identify in the sample lesson plan, activities that could promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3c, 3e - 3g). *E.g.* *Mixed-ability groups were used in the lesson, etc.*	30 mins

	f) *Learners were encouraged to say positive things to colleagues to support their learning (SEL)* g) *Levels were used to cater for differentiation at all levels of learning (GESI/ SEL/Differentiation)* 3.2 Ask teachers to recommend other assessment strategies that could aid in the development of numeracy in learners who struggle with numbers (NTS 1a, 2e, 3f and 3m). *E.g.* a) *Peer assessment* b) *Playing number games (cards, ludo, dominoes, etc.)* c) *Number riddles* d) *Maths quiz* e) *Maths projects* f) *Partner/Peer quizzes* g) *Self-assessment, etc.* 3.3 Ask teachers to show how ICT can be used in assessing numeracy in learners (NTS 3j). *E.g.* a) *Tasking learners to use spreadsheets to compute and analyse data* b) *Using ICT application tools such as socrative, poll everywhere, kahoot, and mentimeter to assess learners* c) *Using mathematical games such as Dominoes and Sudoku for self-assessment*	3.2 Recommend other assessment strategies that could aid in the development of numeracy in learners who struggle with numbers (NTS 1a, 2e, 3f and 3m). *E.g.* *Peer assessment, etc.* 3.3 Show how ICT can be used in assessing numeracy in learners (NTS 3j). *E.g.* *Tasking learners to use spreadsheets to compute and analyse data, etc.*	

	d) Giving learners projects to search online for information *e) Using google forms to quiz learners, etc.* 3.4 Ask a teacher to model a teaching activity based on the sample lesson plan that can support learners who struggle with constructing and inserting simple formulae at the appropriate level, taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 2c). 3.5 Ask teachers to provide feedback on the lesson delivered (NTS 3n, 3o).	3.4 Model a teaching activity based on the sample lesson plan that can support learners who struggle with constructing and inserting simple formulae at the appropriate level, taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 2c). 3.5 Provide feedback on the lesson delivered (NTS 3n, 3o).	
4. Evaluation and review of session: ➢ **Noting that teachers need to identify critical friends to observe lessons and report at next session**	4.1 Ask teachers in groups to reflect, write and share what they have learned with the larger group with regard to supporting the teaching and learning of numeracy at the right level in Information and Communication Technology (ICT) (NTS 1a, 1b). 4.2 Remind teachers to, where possible, identify a critical friend to observe their lesson in relation to PLC Session 5 and provide feedback to them (NTS 3n, 3o). 4.3 Remind teachers to read PLC Session 6 in preparation for the next session.	4.1 In groups, reflect, write and share what you have learned with the larger group with regard to supporting the teaching and learning of numeracy at the right level in Information and Communication Technology (ICT) (NTS 1a, 1b). 4.2 Where possible, identify a critical friend to observe your lesson in relation to PLC Session 5 and provide feedback to them. (NTS 3n, 3o). 4.3 Read PLC Session 6 in preparation for the next session.	10 mins
Appendix 5	*A sample lesson plan for teaching ICT to develop learners' numeracy skills:* *a) Topic: Spreadsheet Application* *b) Sub-Topic:*	*A sample lesson plan for teaching ICT to develop learners' numeracy skills:* *a) Topic: Spreadsheet Application* *b) Sub-Topic:*	

	Application of selected formulae and functions *c) Objectives:* *By the end of the lesson, the learner will be able to:* *i. Construct and insert simple formulae in a spreadsheet* *ii. Use function tools in analysing data* *d) Teaching and Learning Resources (TLRs): Computer, Microsoft Office Excel spreadsheet, projector, cards with arithmetic symbols, etc.* *e) Relevant Previous Knowledge (RPK): Learners can mention some basic parts of a spreadsheet and can identify and interpret arithmetic operations.* *f) Introduction:* *i. In mixed-ability groups, learners are presented cards with arithmetic symbols placed face down. Teacher throws a soft ball to a group. A learner in the group catches the ball, picks one card and tells the symbol on it. The learner then throws the ball to another group and the group that catches it, explains what the symbol does. The process is repeated to exhaust all the cards.* *ii. In an all-inclusive class discussion, guide learners to mention some basic parts of a*	*Application of selected formulae and functions* *c) Objectives:* *By the end of the lesson, the learner will be able to:* *i. Construct and insert simple formulae in a spreadsheet* *ii. Use function tools in analysing data* *d) Teaching and Learning Resources (TLRs): Computer, Microsoft Office Excel spreadsheet, projector, cards with arithmetic symbols, etc.* *e) Relevant Previous Knowledge (RPK): Learners can mention some basic parts of a spreadsheet and can identify and interpret arithmetic operations.* *f) Introduction:* *i. In mixed-ability groups, learners are presented cards with arithmetic symbols placed face down. Teacher throws a soft ball to a group. A learner in the group catches the ball, picks one card and tells the symbol on it. The learner then throws the ball to another group and the group that catches it, explains what the symbol does. The process is repeated to exhaust all the cards.* *ii. In an all-inclusive class discussion, guide learners to mention some basic parts of a spreadsheet and explain that the lesson will be making use of*	

	spreadsheet and explain that the lesson will be making use of arithmetic operations to construct formulae in spreadsheets. *g) Tasks/Activities:* *i. With the aid of a computer and a projector, guide learners in their various groups to launch a spreadsheet application on their computers. Let them point out the features/parts/tools identified on the interface of the spreadsheet. Encourage peers to support each other to perform the task.* *ii. Present alpha-numeric data and guide learners to construct a table on the spreadsheet with the data. Move around the groups and encourage the participation of all learners with diverse abilities.* *Level 1:* *Accept data entries containing 10 items from learners.* *Level 2:* *Accept data entries containing 15 items from learners.* *Level 3:* *Accept data entries containing 20 items*	*arithmetic operations to construct formulae in spreadsheets.* *g) Tasks/Activities:* *i. With the aid of a computer and a projector, guide learners in their various groups to launch a spreadsheet application on their computers. Let them point out the features/parts/tools identified on the interface of the spreadsheet. Encourage peers to support each other to perform the task.* *ii. Present alpha-numeric data and guide learners to construct a table on the spreadsheet with the data. Move around the groups and encourage the participation of all learners with diverse abilities.* *Level 1:* *Accept data entries containing 10 items from learners.* *Level 2:* *Accept data entries containing 15 items from learners.* *Level 3:* *Accept data entries containing 20 items and above from learners.*	

	and above from learners. *iii. Discuss with learners how to create formulae using arithmetic operational signs (+, × ÷, ≥, =, etc.). Encourage learners to respect the contributions of others. Let learners be aware the things they say either positive or negative affect their colleagues' learning.* *Level 1:* *Create spreadsheet formulae involving one operational sign.* *Level 2:* *Create spreadsheet formulae involving two operational signs.* *Level 3:* *Create spreadsheet formulae using multiple operational signs.* *iv. In mixed-ability groups, discuss with learners the spreadsheet function tools and guide them to use these tools to analyse and interpret a given data.* *Level 1:* *Use one spreadsheet function tool, for example Autosum, to compute and analyse data.* *Level 2:* *Use two spreadsheet function tools, for*	*iii. Discuss with learners how to create formulae using arithmetic operational signs (+, ×, ÷, ≥, =, etc.). Encourage learners to respect the contributions of others. Let learners be aware the things they say either positive or negative affect their colleagues' learning.* *Level 1:* *Create spreadsheet formulae involving one operational sign.* *Level 2:* *Create spreadsheet formulae involving two operational signs.* *Level 3:* *Create spreadsheet formulae using multiple operational signs.* *iv. In mixed-ability groups, discuss with learners the spreadsheet function tools and guide them to use these tools to analyse and interpret a given data.* *Level 1:* *Use one spreadsheet function tool, for example Autosum, to compute and analyse data.* *Level 2:* *Use two spreadsheet function tools, for*	

	example Autosum and Percentages, to compute and analyse data. *Level 3:* *Use at least three spreadsheet function tools, for example Autosum, Percentages, Averages, Max, Min, etc., to compute and analyse data.* *h) Core Points:* *i. Constructing or creating formulae on spreadsheets:* ➢ *Launch an Excel* ➢ *Select an empty cell* ➢ *Type an equal sign (=) then type a function. For example =Sum* ➢ *Type an opening parenthesis* ➢ *Select the range of cells and type a closing parenthesis* ➢ *Press enter to get the result* *ii. Using function tool to analyse data:* ➢ *Autosum to find totals* ➢ *Average function to find the mean of a given data, etc.* ➢ *Percentage function to interpret frequencies* ➢ *Max and Min functions to determine the highest and lowest values, etc.*	*example Autosum and Percentages, to compute and analyse data.* *Level 3:* *Use at least three spreadsheet function tools, for example Autosum, Percentages, Averages, Max, Min, etc., to compute and analyse data.* *h) Core Points:* *i. Constructing or creating formulae on spreadsheets:* ➢ *Launch an Excel* ➢ *Select an empty cell* ➢ *Type an equal sign (=) then type a function. For example =Sum* ➢ *Type an opening parenthesis* ➢ *Select the range of cells and type a closing parenthesis* ➢ *Press enter to get the result* *ii. Using function tools to analyse data:* ➢ *Autosum to find totals* ➢ *Average function to find the mean of a given data, etc.* ➢ *Percentage function to interpret frequencies* ➢ *Max and Min functions to determine the highest and lowest values, etc.*	

i) *Core Competencies:*
   i. *Digital literacy*
   ii. *Problem solving skills*
   iii. *Collaboration skills*
   iv. *Critical thinking skills*
   v. *Personal development*

j) *Conclusion:*
Review lesson with learners by asking them in their various groups to summarise what they have learned in the lesson.

k) *Evaluation:*
Use the following data to answer the questions that follow:

S/N	Name	Class Score	Exams Score
1	Esther	25	50
2	Aaron	22	58
3	Kwaku	26	46
4	Ansbert	22	55
5	Dedey	20	60
6	Beryl	24	61
7	Fletcher	16	68

   i. *Create a spreadsheet with the data. (Level 1)*
   ii. *Find the total score for each student using Excel formulae. (Level 2)*
   iii. *Apply the Excel function tools to compute the average, maximum and minimum scores. (Level 3)*

l) *Remarks:*

i) *Core Competencies:*
   i. *Digital literacy*
   ii. *Problem solving skills*
   iii. *Collaboration skills*
   iv. *Critical thinking skills*
   v. *Personal development*

j) *Conclusion:*
Review lesson with learners by asking them in their various groups to summarise what they have learned in the lesson.

k) *Evaluation:*
Use the following data to answer the questions that follow:

S/N	Name	Class Score	Exams Score
1	Esther	25	50
2	Aaron	22	58
3	Kwaku	26	46
4	Ansbert	22	55
5	Dedey	20	60
6	Beryl	24	61
7	Fletcher	16	68

   i. *Create a spreadsheet with the data. (Level 1)*
   ii. *Find the total score for each student using Excel formulae. (Level 2)*
   iii. *Apply the Excel function tools to compute the average, maximum and minimum scores. (Level 3)*

l) *Remarks:*

PLC Session 6: Supporting the teaching and learning of numeracy at the right level in Technical and Vocational Education and Training.

TVET Domain:
1. Agricultural Science
2. Home Economics
3. Technical
4. Visual Art

Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do and say during each session. Each bullet needs to be addressed	**Guidance notes on Leading the session.** *What the PLC Coordinator will have to say during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking a teacher to share what they did differently in the classroom or elsewhere based on PLC Session 5, *on supporting the teaching and learning of numeracy at the right level in ICT*, which they think impacted learning positively. 1.2 Ask teachers to discuss and summarise in a single sentence why they think what a colleague did by way of	1.1 Share what you did differently in the classroom or elsewhere based on PLC Session 5, *on supporting the teaching and learning of numeracy at the right level in ICT*, which you think impacted learning positively. 1.2 Discuss and summarise in a single sentence why you think what your colleague did by way of application of what you	20 mins

	application of what they learned in Session 5, *on supporting the teaching and learning of numeracy at the right level in ICT,* supported learning (NTS 1a).	learned in Session 5, *on supporting the teaching and learning of numeracy at the right level in ICT*, supported learning (NTS 1a).	
2. Planning for teaching, learning and assessment activities, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session (NTS 1b, 2b - 2d, and 3i). **Purpose:** The purpose of the session is to discuss how to support the teaching and learning of numeracy at the right level across the TVET/SHS curriculum and how numeracy can support the teaching and learning of TVET. *Note:* *Numeracy across the curriculum is a way of integrating mathematical skills into different subjects across the curriculum. Numeracy skills involve understanding numbers, counting, solving number problems, measuring, estimating, sorting, noticing patterns, adding and subtracting numbers. Improving numeracy skills among learners leads to better understanding of concepts and skill development, greater wellbeing and a less stressful life* LO 1: Demonstrate knowledge and understanding of how to apply numeracy at the right level across the TVET/SHS	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session (NTS 1b, 2b - 2d, and 3i). **Purpose:** The purpose of the session is to discuss how to support the teaching and learning of numeracy at the right level across the TVET/SHS curriculum and how numeracy can support the teaching and learning of TVET. *Note:* *Numeracy across the curriculum is a way of integrating mathematical skills into different subjects across the curriculum. Numeracy skills involve understanding numbers, counting, solving number problems, measuring, estimating, sorting, noticing patterns, adding and subtracting numbers. Improving numeracy skills among learners leads to better understanding of concepts and skill development, greater wellbeing and a less stressful life* LO 1: Demonstrate knowledge and understanding of how to apply numeracy at the right level across the TVET/SHS curriculum (NTS 1a, 2c - 2f, 3a and 3e – 3k).	30 mins

	curriculum (NTS 1a, 2c - 2f, 3a and 3e – 3k). LI 1.1 Identify three ways of applying numeracy at the right level across the TVET/SHS curriculum. LI 1.2 Discuss the various numeracy strategies that can be used to develop TVET concepts at the right level. LO2: Demonstrate knowledge and understanding of how to apply TVET concepts to support numeracy across the curriculum (NTS 1a, 2c - 2f, 3a and 3e – 3k). LI 2.1 Identify three ways TVET concepts can support numeracy at the right level across the curriculum. LI 2.2 Prepare a sample lesson plan to show practical activities of how TVET supports the teaching and learning of numeracy at the right level across the TVET/SHS curriculum. 2.2 Ask teachers in their TVET domain groups to identify ways of applying numeracy at the right level across the TVET/SHS curriculum (NTS 2c, 2d, and 3i). *E.g.* *a) Use of varied activities such as sorting, grouping, mapping, tallying and plotting graphs* *b) Use of varied teaching and learning resources such as manipulatives,*	LI 1.1 Identify three ways of applying numeracy at the right level across the TVET/SHS curriculum. LI 1.2 Discuss the various numeracy strategies that can be used to develop TVET concepts at the right level. LO2**:** Demonstrate knowledge and understanding of how to apply TVET concepts to support numeracy across the curriculum (NTS 1a, 2c - 2f, 3a and 3e – 3k). LI 2.1 Identify three ways TVET can support numeracy at the right level across the curriculum. LI 2.2 Prepare a sample lesson plan to show practical activities of how TVET supports the teaching and learning of numeracy at the right level across the TVET/SHS curriculum. 2.2 In your TVET domain, groups identify ways of applying numeracy at the right level across the TVET/SHS curriculum (NTS 2c, 2d and 3i). *E.g.* *Use of varied activities such as sorting and grouping, etc.*	

	flow charts, flash cards, and videos c) *Use cooperative learning strategies to enable learners think outside the box, etc.* 2.3 Ask teachers to discuss at least two numeracy strategies that can be used to develop TVET concepts at the right level (NTS 1b, 2c- 2e, 3f and 3g). *E.g.* a) *Using concepts in maths such as: Subtraction can be described as 'takeaway' or 'removing'* b) *Combining words and numbers to provide a complete understanding such as four (4)* c) *Using visual images and shapes to reflect the meaning of concepts* d) *Measuring quantities in kilograms and grammes, etc.* 2.4 Ask teachers to identify three (3) ways TVET concepts can support numeracy at the right level across the curriculum (NTS 2c, 2d). *E.g.* a) *Use of classification to group tools and equipment as in sets* b) *Measuring, recording and charting figures* c) *Recognising shapes of tools and equipment, etc.*	2.3 Discuss at least two numeracy strategies that can be used to develop TVET concepts at the right level (NTS 1b, 2c- 2e, 3f and 3g). *E.g.* *Using concepts in maths such as: Subtraction can be described as 'takeaway' or 'removing', etc.* 2.4 Identify three (3) ways TVET concepts can support numeracy at the right level across the curriculum (NTS 2c, 2d). *E.g.* *Use of classification to group tools and equipment as in sets, etc.* 2.5 In your TVET domain prepare a sample lesson plan to	

	2.5 Ask teachers in their TVET domain to prepare a sample lesson plan to show practical activities of how TVET supports the teaching and learning of numeracy at the right level across the TVET/SHS curriculum (NTS 2a - 2c, 3a and 3f - 3k). *Refer to the sample lesson plan in Appendix 6*	show practical activities of how TVET supports the teaching and learning of numeracy at the right level across the TVET/SHS curriculum (NTS 2a - 2c, 3a and 3f - 3k). *Refer to the sample lesson plan in Appendix 6*	
3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	3.1 Ask teachers in their TVET domain groups to identify in their sample lesson plan, activities that could promote GESI, SEL, ICT, differentiation and 21st century skills responsiveness (NTS 3f). *E.g.* *a) Learners were engaged in mixed-ability/mixed-gender/mixed-culture groups to encourage active participation of males/females and SEN learners (GESI/SEL)* *b) Learners were given the opportunity to share their ideas to the whole class using different presentation modes (SEL/Differentiation)* *c) Learners were given differentiated activities (Differentiation)* *d) Learners were engaged in critical thinking, communication, collaborative skills, leadership skills through pair and group work (21st century skills)* *e) Learners were engaged to watch pre-*	3.1 In your TVET domain groups, identify in your sample lesson plan activities that could promote GESI SEL, ICT, differentiation and 21st Century skills responsiveness (NTS 3f). *E.g.* *Learners were engaged in mixed-ability/mixed-gender/mixed-culture groups to encourage active participation of males/females and SEN learners, etc.*	30 mins

	prepared/YouTube videos on TVET tools and equipment (ICT) 3.2 Ask teachers to recommend other appropriate strategies that could aid in the development of numeracy skills in learners (NTS 1a, 2e, 3f and 3m). *E.g.* *a) Peer matching* *b) Project work* *c) Description of shapes* *d) Games/puzzles* *e) Graph presentation, etc.* 3.3 Ask teachers to show how ICT can be used to support the teaching and learning of numeracy across the TVET/SHS curriculum (NTS 3j). *E.g.* *a) Showing YouTube/Pre-recorded videos and podcast on data on TVET tools and equipment* *b) Using interactive whiteboard to present TVET tools and equipment for learners to group according to their weights and shapes* *c) Giving learners assignments to be presented in charts and figures using PowerPoint* *d) Giving learners projects to search online for dimensions of TVET tools and equipment, etc.*	3.2 Recommend other appropriate strategies that could aid in the development of numeracy skills in learners (NTS 1a, 2e, 3f and 3m). *E.g.* *Peer matching, etc.* 3.3 Show how ICT can be used to support the teaching and learning of numeracy across the TVET/SHS curriculum (NTS 3j). *E.g.* *Showing YouTube/Pre-recorded videos and podcast on data on TVET tools and equipment, etc.*	

	3.4 Ask a teacher to model a teaching activity based on the sample lesson plan that can support learners to develop numeracy skills at the right level, taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 2c). 3.5 Ask teachers to give feedback on the lesson observed (NTS 1a, 2c).	3.4 Model a teaching activity based on the sample lesson plan that can support learners to develop numeracy skills at the right level, taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 2c). 3.5 Give feedback on the lesson observed (NTS 1a, 2c).	
4. Evaluation and review of session: **Noting that teachers need to identify critical friends to observe lessons and report at next session**	4.1 Ask teachers to reflect, write and share what they have learned with the larger group on how to support the teaching and learning of numeracy across the TVET/ SHS curriculum (NTS 1a, 1b). 4.2 Remind teachers to, where possible, identify a critical friend to observe their lesson in relation to PLC Session 6 and provide feedback to them (NTS 1a, 3n and 3o). 4.3 Remind teachers to read PLC Session 7 in preparation for the next session.	4.1 Reflect, write and share what you have learnt with the larger group on how to support the teaching and learning of numeracy across the TVET/ SHS curriculum (NTS 1a, 1b). 4.2 Where possible, identify a critical friend to observe your lesson in relation to PLC Session 6 and provide feedback to you (NTS 1a, 3n and 3o). 4.3 Read PLC Session 7 in preparation for the next session.	10 mins
Appendix 6	*A sample TVET lesson plan to support the teaching and learning of numeracy at the right level.* *a) Topic:* *Tools and Equipment in Technical, Agriculture, Visual Arts and Home Economics.* *b) Sub-Topic:* *Classification of tools and equipment in Technical, Agriculture, Visual Arts and Home Economics.* *Refer to MoE (2010) teaching syllabus for TVET*	*A sample TVET lesson plan to support the teaching and learning of numeracy at the right level.* *a) Topic:* *Tools and Equipment in Technical Skills, Agriculture, Visual Arts and Home Economics.* *b) Sub-Topic:* *Classification of tools and equipment in Technical, Agriculture, Visual Arts and Home Economics.* *Refer to MoE (2010) teaching syllabus for TVET*	

	c) *Lesson Objectives:* *By the end of the lesson learners will be able to:* *i. List at least 4 tools and equipment used in technical, agriculture, visual arts and home economics.* *ii. Discuss at least 4 uses of tools and equipment in technical, agriculture, visual arts and home economics and present the information in charts.* *iii. Classify the tools and equipment in technical, agriculture, visual arts and home economics according to their uses and present the information, using charts, figures and tables.* d) *Teaching and learning resources (TLRs):* *i. Videos/pictures on tools and equipment* *ii. Sample tools and equipment, manipulatives, charts and concept maps* *iii. Laboratories/workshops/studios and farms* iv. *Laptops, projectors, and mobile phones where possible, etc.* e) *Relevant Previous Knowledge (RPK):* *Learners use tools and equipment in their daily activities*	c) *Lesson Objectives: By the end of the lesson learners will be able to:* *i. List at least 4 tools and equipment used in technical, agriculture, visual arts and home economics.* *ii. Discuss at least 4 uses of tools and equipment in technical, agriculture, visual arts and home economics and present the information in charts.* *iii. Classify the tools and equipment in technical, agriculture, visual arts and home economics according to their uses and present the information, using charts, figures and tables.* d) *Teaching and learning resources (TLRs):* *i. Videos/pictures on tools and equipment* *ii. Sample tools and equipment, manipulatives, charts and concept maps* *iii. Laboratories/workshops/studios and farms* *iv. Laptops, projectors, and mobile phones where possible, etc.* e) *Relevant Previous Knowledge (RPK):* *Learners use tools and equipment in their daily activities*	

	f) Introduction: *Introduce the lesson using starters such as mapping activities, stories, riddles, narratives related to the topic e.g., I am a tool used for cutting, what am I? (Knife, scissors, blade, shears etc.)* *g) Teaching and Learning activities:* *i. In mixed-ability/mixed-gender/mixed-cultural groups, learners visit/watch videos of local and modern TVET industries to explore the different tools and equipment used in technical, agriculture, visual arts and home economics.* *ii. Level 1* *Ask learners to write the names of five tools and equipment they observed.* *Level 2* *Ask learners to sketch at least 2 different tools and equipment they observed.* *Level 3* *Ask learners to classify, count the tools and equipment and present the result in a chart.*	*f) Introduction:* *Introduce the lesson using starters such as mapping activities, stories, riddles, narratives related to the topic e.g., I am a tool used for cutting, what am I? (Knife, scissors, blade, shears etc.)* *g) Teaching and Learning activities:* *i. In mixed-ability/mixed-gender/mixed-cultural groups, learners visit/watch videos of local and modern TVET industries to explore the different tools and equipment used technical, agriculture, visual arts and home economics.* *ii. Level 1* *Ask learners to write the names of five tools and equipment they observed.* *Level 2* *Ask learners to sketch at least 2 different tools and equipment they observed.* *Level 3* *Ask learners to classify, count the tools and equipment and present the result in a chart.*	

	iii. *Ask learners in pairs/groups to discuss and state the number of uses of tools and equipment they have found and present the information in a table form.* iv. *Ask learners in pairs/pyramid groupings to classify sample tools and equipment used in the various TVET domains and present the information, using mapping, charts, figures and tables. Monitor to provide support to learners where necessary.* *Note:* *Guide learners to count, tally or chart the tools and equipment under the various groups* *E.g.* *Small tools and equipment* *~~////////////~~ ////: 19 (nineteen)* *h) Core points:* *i. Tools and Equipment:* ➢ *Technical: Tape measure, trowel, wooden float, drawing instruments, concrete mixture and spirit level, etc.* ➢ *Agriculture: Hoe, machete, rope, wheelbarrow,*	iii. *Ask learners in pairs/groups to discuss and state the number of uses of the tools and equipment they found and present the information in a table form.* iv. *Ask learners in pairs/pyramid groupings to classify sample tools and equipment used in the various TVET domains and present the information, using mapping, charts, figures and tables. Monitor to provide support to learners where necessary.* *Note:* *Guide learners to count, tally or chart the tools and equipment under the various groups* *E.g.* *Small tools and equipment* *~~////////////~~ ////: 19 (nineteen)* *h) Core points:* *i. Tools and Equipment:* ➢ *Technical: Tape measure, trowel, wooden float, drawing instruments, concrete mixture, spirit level, etc.* ➢ *Agriculture: Hoe, rack, machete, rope, wheelbarrow,*	

	pruning shears, tractor, etc. ➢ *Visual Arts: Painting brush, paper cutter, scissors, computer, tables, sand paper, chisel, Digital printing machine, loom, binding machine, etc.* ➢ *Home Economics: Sewing machine, knife, saucepans, coalpot, mortar, scissors, tape measure, broom, mop, electric stove industrial sewing machine, etc.* *ii. Uses of some of the tools and equipment* *These are used to perform different activities such as;* ➢ *knife for cutting* ➢ *tape measure for measuring* ➢ *binding machine for binding,* ➢ *brush for painting,* ➢ *mop for cleaning,* ➢ *loom for weaving* ➢ *spirit-level for laying, etc.* ➢ *iii. Classification based on size of tools and equipment:* ➢ *Small tools and equipment; tape measure, trowel, wooden float, pruning shears, painting brush, paper cutter, chisel,*	*pruning shears, tractor, etc.* ➢ *Visual Arts: Painting brush, paper cutter, scissors, computer, tables, sand paper, chisel, Digital printing machine, loom, binding machine, etc.* ➢ *Home Economics: Sewing machine, knife, saucepans, coalpot, mortar, scissors, tape measure, sweeping broom, mop, electric stove, industrial sewing machine, etc.* *ii. Uses of some of the tools and equipment* *These are used to perform different activities such as;* ➢ *knife for cutting* ➢ *tape measure for measuring* ➢ *binding machine for binding,* ➢ *brush for painting,* ➢ *mop for cleaning,* ➢ *loom for weaving* ➢ *spirit-level for laying, etc.* *iii. Classification based on size of tools and equipment:* ➢ *Small tools and equipment; tape measure, trowel, wooden float, pruning shears, painting brush, paper cutter, chisel,*	

	knife, saucepans, coal pots, mortar, scissors, tape measure, sweeping broom, mop, etc. ➢ *Large tools and equipment; big tables, big mortar, concrete mixture, tractor, digital printing machine, loom, industrial sewing machine, etc.* *iv. Classification based on function of tools and equipment:* ➢ *Cutting tools; knife, scissors, drill, pinking shears, machete, etc.* ➢ *Measuring tools; tape measure, drawing instrument, rope, scale, etc.* *i) Core competencies:* *i. Critical thinking* *ii. Communication skills* *iii. Collaboration skills* *iv. Counting skills* *v. Leadership skills* *j) Conclusion:* *Use the question-and-answer method to find out from learners what they have learned.* *k) Evaluation* *i. Level 1:* *List four (4) tools and equipment used in technical, agriculture, visual arts and home economics.*	*knife, saucepans, coal pots, mortar, scissors, tape measure, sweeping broom, mop, etc.* ➢ *Large tools and equipment; big tables, big mortar, concrete mixture, tractor, digital printing machine, loom, industrial sewing machine, etc.* *iv. Classification based on function of tools and equipment:* ➢ *Cutting tools; knife, scissors, drill, pinking shears, machete, etc.* ➢ *Measuring tools; tape measure, drawing instrument, rope, scale, etc.* *i) Core competencies:* *i. Critical thinking* *ii. Communication skills* *iii. Collaboration skills* *iv. Counting skills* *v. Leadership skills* *j) Conclusion:* *Use the question-and-answer method to find out from learners what they have learned.* *k) Evaluation* *i. Level 1:* *List four (4) tools and equipment used in technical, agriculture, visual arts and home economics.*	

	ii. *Level 2:* *Discuss the uses of four (4) tools and equipment in technical, agriculture, visual arts and home economics.* iii. *Level 3:* *Classify the tools and equipment according to their uses using tables/ charts/concept mapping in technical, agriculture, visual arts and home economics.* *l) Remarks:*	ii. *Level 2:* *Discuss the uses of four (4) tools and equipment in technical, agriculture, Visual arts and Home Economics.* iii. *Level 3:* *Classify the tools and equipment according to their uses using tables/ charts/concept mapping in technical, agriculture, visual arts and home economics.* *l) Remarks:*	

Session 7: Supporting the teaching and learning of numeracy at the right level in business studies			
Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do and say during each session. Each bullet needs to be addressed	**Guidance notes on Leading the session.** *What the PLC Coordinator will have to say during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking teachers to share what they did differently in the classroom or elsewhere based on PLC Session 6, on *supporting the teaching and learning of numeracy at the right level in Technical and Vocational Education and Training (TVET)*, which they think impacted learning positively. 1.2 Ask teachers to discuss and summarise in a single sentence why they think what their colleague did by way of application of what they learned in Session 6, on *supporting the teaching and learning of numeracy at the right level in TVET,* supported learning.	1.1 Share what you did differently in the classroom or elsewhere based on PLC Session 6, on *supporting the teaching and learning of numeracy at the right level in Technical and Vocational Education and Training (TVET)*, which you think impacted learning positively. 1.2 Discuss and summarise in a single sentence why you think what your colleague did by way of application of what you learned in Session 6, on *supporting the teaching and learning of numeracy at the right level in TVET,* supported learning.	20 mins

2. Planning for teaching, learning and assessment activities, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session. **Purpose:** The purpose of the session is to discuss the identification and strategies for using numeracy skills to support the teaching and learning of business studies, and vice versa. LO 1: Demonstrate knowledge, understanding and application of the numeracy skills in business studies (NTS 1b, 2c - 2f, 3g and 3i). LI 1.1 Identify mathematical concepts in teaching and learning of business studies. LI 1.2 Analyse at least three strategies of applying numeracy in teaching and learning of business studies at the right level. LO 2: Demonstrate knowledge and understanding of how concepts in business studies support the teaching and learning of numeracy skills	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session. **Purpose:** The purpose of the session is to discuss the identification and strategies for using numeracy skills to support the teaching and learning of business studies, and vice versa. LO 1: Demonstrate knowledge, understanding and application of the concept of numeracy skills in business studies (NTS 1b, 2c -2f, 3g and 3i). LI 1.1 Identify mathematical concepts in teaching and learning of business studies. LI 1.2 Analyse at least three strategies of applying numeracy in teaching and learning of business studies at the right level. LO 2: Demonstrate knowledge and understanding of how concepts in business studies support the teaching and learning of numeracy skills	30 mins

	(NTS 1b, 2c - 2f, 3g and 3i). LI 2.1 Identify concepts in business studies that support the teaching and learning of numeracy skills. LI 2.2 Analyse how business studies as a discipline provides opportunities for the teaching and learning of numeracy. 2.2 Ask teachers in pairs, to mention at least three mathematical concepts that can be used in the teaching and learning of business studies (NTS 2c). *E.g.* *a) counting, addition, subtraction, multiplication, division of numbers as used in cost accounting and financial accounting* *b) investigation and problem solving in business management* *c) data collection and noticing patterns in economics* *d) estimation in financial accounting and cost accounting* *e) analysing and making sense of information in business management, etc.*	(NTS 1b, 2c-2f, 3g and 3i). LI 2.1 Identify concepts in business studies that support the teaching and learning of numeracy skills. LI 2.2 Analyse how business studies as a discipline provides opportunities for the teaching and learning of numeracy. 2.2 In pairs, mention at least three mathematical concepts that can be used in the teaching and learning of business studies (NTS 2c). *E.g.* *counting, addition, subtraction, multiplication, division of numbers as used in cost accounting and financial accounting, etc.*	

	2.3 Ask teachers in pairs to enumerate how useful the application of numeracy skills is to the teaching and learning of business studies (NTS 2c-2f, 3f and 3g). *E.g.* *a) The acquisition of numeracy skills helps learners to improve their speed and performance in solving problems in business studies* *b) Numeracy helps learners to reduce the number of computational errors during accounting lessons* *c) It helps learners to understand the principles of financial management* *d) It helps learners to make informed judgement in logical reasoning in business management, etc.* 2.4 Ask teachers to analyse at least three strategies for applying numeracy skills in teaching and learning of business studies at the right level (NTS 2c - 2f, 3f and 3g). *E.g.* *a) Developing activities that will help learners identify numeracy*	2.3 In pairs, enumerate how useful the application of numeracy skills is to the teaching and learning of business studies (NTS 2c-2f, 3f and 3g). *E.g.* *The acquisition of numeracy skills helps learners to improve their speed and performance in solving problems in business studies, etc.* 2.4 Analyse at least three strategies for applying numeracy skills in teaching and learning of business studies at the right level (NTS 2c - 2f, 3f and 3g). *E.g.* *Developing activities that will help learners identify numeracy*	

	concepts such as number, addition, subtraction, patterns, time and data collection during business studies *b) Guiding learners to identify the numeracy skills necessary for solving problems during business studies lessons* *c) Giving remediation to learners with challenges in the application of numeracy skills* *d) Having clear teaching goals that include numeracy objectives* *e) Encouraging learners to spot opportunities to practise their numeracy skills, etc.* 2.5 Ask teachers in their departmental groups to identify concepts in business studies that support the teaching and learning of numeracy skills (NTS 2c-2f). *E.g.* *a) The use of diagrams in economics* *b) Balancing accounts in*	*concepts, such as number, during business studies, etc.* 2.5 In your departmental group, identify concepts in business studies that support the teaching and learning of numeracy skills (NTS 2c-2f). *E.g.* *The use of diagrams in economics, etc.*	

	financial accounting *c) Case studies under business management, etc.* 2.6 Ask teachers to discuss a sample lesson plan in business studies and show how it can be taught with the support of numeracy for learners who may struggle with numbers and computational skills (NTS 3e - 3l). *Refer to Appendix 7 for a sample lesson plan in business studies for learners at the appropriate level*	2.6 Discuss a sample lesson plan in business studies and show how it can be taught with the support of numeracy for learners who may struggle with numbers and computational skills (NTS 3e - 3l). *Refer to Appendix 7 for a sample lesson plan in business studies for learners at the appropriate level*	
3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	3.1 Ask teachers to identify in the sample lesson plan, activities that could promote GESI, SEL, ICT, 21st century skills, and differentiation (NTS 3a - 3c, 3e - 3g). *E.g.* *a) Teacher used mixed-ability and mixed-gender groupings during role play in teaching the concept money (GESI/ SEN)* *b) Positive feedback was given to all learners especially SEN learners (21st century skills/SEL)* *c) Teacher assigned differentiated tasks to learners*	3.1 Identify in the sample lesson plan, activities that could promote GESI, SEL, ICT, 21st century skills, and differentiation (NTS 3a - 3c, 3e - 3g). *E.g.* *Teacher used mixed-ability and mixed-gender groupings during small group discussion in teaching the concept of money, etc.*	30 mins

	(21st century skills/ Differentiation) d) *Projected YouTube videos (21st century skills/ICT)* 3.2 Ask teachers to recommend other appropriate assessment strategies in the lesson plan that could aid in the development of numeracy skills in learners who may struggle with developing computational skills and logical reasoning (NTS 1a, 2e, 3f, 3k and 3m). *E.g.* a) *Mental activities* b) *Peer teaching* c) *Self-practice* d) *Brainwriting* e) *Presentation* f) *Portfolio building, etc.* 3.3 Ask teachers to explain how ICT can be used in assessing learners of business studies (NTS 3j). *E.g.* a) *Watching and reporting information on money and banking from YouTube/Pre-recorded videos and podcast* b) *Giving learners assignments on*	3.2 Recommend other appropriate assessment strategies in the lesson plan that could aid in the development of numeracy skills in learners who may struggle with developing computational skills and logical reasoning (NTS 1a, 2e, 3f, 3k and 3m). *E.g.* *Mental activities, etc.* 3.3 Explain how ICT can be used in assessing learners of business studies (NTS 3j). *E.g.* *Watching and reporting information on money and banking from YouTube/Pre-recorded videos and podcast, etc.*	

	the concept of money that would involve numeracy to be presented in PowerPoint *c) Giving learners projects to search online for information on a topic in business studies* *d) Using google forms to quiz learners, etc.* 3.4 Ask a teacher to model a teaching activity based on the sample lesson plan that can support all learners taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 1b, 2c and 3c). 3.5 Ask teachers to give feedback on the lesson delivered (NTS 1a, 2c).	3.4 Model a teaching activity based on the sample lesson plan that can support all learners taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 1b, 2c and 3c). 3.5 Give feedback on the lesson delivered (NTS 1a, 2c).	
4. Evaluation and review of session: **Noting that teachers need to identify critical friends to observe lessons and report at next session**	4.1 Ask teachers in groups to reflect, write and share what they have learned with the larger group with regard to the support numeracy gives in the teaching and learning of business studies (NTS 1a, 1b). 4.2 Remind teachers to, where possible, identify a critical friend to observe their lesson in relation to PLC Session 7 and provide feedback at the next PLC session (NTS 3l, 3n and 3o).	4.1 In your group, reflect, write and share what you have learned with the larger group with regard to the support numeracy gives in the teaching and learning of business studies (NTS 1a, 1b). 4.2 Where possible, identify a critical friend to observe your lesson in relation to PLC Session 7 and provide feedback at the next PLC session (NTS 3l, 3n and 3o).	10 mins

	4.3 Remind teachers to read PLC Session 8 in preparation for the next session.	4.3 Read PLC Session 8 in preparation for the next session.	
Appendix 7	*A sample lesson plan for teaching the concept of money and banking (SHS 2) from the MoE (2010) SHS business management syllabus is provided below:* *a) Topic:* *Money and Banking* *b) Sub-topic:* *Characteristics and Functions of money* *c) Objectives:* *By the end of the lesson, the learner will be able to:* *i. State at least three characteristics of money* *ii. Explain at least two functions of money* *d) Teaching and Learning Resources (TLRs): Ghana cedi coins and banknotes, token currency notes, task sheets for pick and role-play, calculator, computer and projector.* *e) Relevant Previous Knowledge (RPK): Learners see and use various Ghana cedi denominations for transactions.*	*A sample lesson plan for teaching the concept of money and banking (SHS 2) from the MoE (2010) SHS business management syllabus is provided below:* *a) Topic:* *Money and Banking* *b) Sub-topic:* *Characteristics and Functions of money* *c) Objectives:* *By the end of the lesson, the learner will be able to:* *i. State at least three characteristics of money* *ii. Explain at least two functions of money* *d) Teaching and Learning Resources (TLRs):* *Ghana cedi coins and banknotes, token currency notes, task sheets for pick and role-play, calculator, computer and projector.* *e) Relevant Previous Knowledge (RPK): Learners see and use various Ghana cedi denominations for transactions.*	

	f) Introduction: *Ask learners to tell the amount of money they spend on food and other items.* *g) Tasks/Activities:* *i. Guide learners through mixed-ability groups to categorise the various Ghana cedi denominations according to type (coins and banknotes) and size (face value) and state at least three characteristics of it.* *ii. Provide learners with token currency notes and coins and guide them in groups to pick a task sheet at random and role-play what is on the sheet (task on banking, open market or "susu" collection settings). Let learners appreciate their peers' performance during the role-play.* *iii. Ask learners to mention as many as possible, the functions of money identified during the*	*f) Introduction:* *Ask learners to tell the amount of money they spend on food and other items.* *g) Tasks/Activities:* *i. Guide learners through small mixed-ability groups to categorise the various Ghana cedi denominations according to type (coins and banknotes) and size (face value) and state at least three characteristics of it.* *ii. Provide learners with token currency notes and coins and guide them in groups to pick a task sheet at random and role-play what is on the sheet (task on banking, open market or "susu" collection settings). Let learners appreciate their peers' performance during the role-play.* *iii. Ask learners to mention as many as possible, the functions of money identified during*	

	pick and role-play activity. *iv. Project a YouTube video in class to show how the automated teller machine operates.* *h) Core points:* *i. Characteristics of money include:* ➢ *portability* ➢ *homogeneity* ➢ *divisibility* ➢ *recognisability* ➢ *durability* ➢ *acceptability and* ➢ *stability of value* *ii. Functions of money include:* ➢ *store of wealth or unit of account* ➢ *medium of exchange* ➢ *measure of value and* ➢ *standard of deferred payment* *i) Core competencies:* *i. Numeracy skills are enhanced when learners count and add money during group work.* *ii. Critical thinking and problem-solving skills are developed when learners analyse and sort currency denominations.*	*the pick and role-play activity.* *iv. Project a YouTube video in class to show how the automated teller machine operates.* *h) Core points:* *i. Characteristics of money include:* ➢ *portability* ➢ *homogeneity* ➢ *divisibility* ➢ *recognisability* ➢ *durability* ➢ *acceptability and* ➢ *stability of value* *ii. Functions of money include:* ➢ *store of wealth or unit of account* ➢ *medium of exchange* ➢ *measure of value and* ➢ *standard of deferred payment* *i) Core competencies:* *i. Numeracy skills are enhanced when learners count and add money during group work.* *ii. Critical thinking and problem-solving skills are developed when learners analyse and sort currency denominations.*	

	iii. *Communication and collaborative skills are developed when learners engage in group activities.* *j) Conclusion:* *Ask learners to mention what they have learned from the lesson and how they intend to apply it at home.* *k) Evaluation:* i. *Write three uses of money in a modern economy. (level 1)* ii. *Explain at least two characteristics of money. (level 2)* iii. *Discuss whether or not Ghana's currency is accepted as a legal tender. (level 3)* *l) Remarks:*	iii. *Communication and collaborative skills are developed when learners engage in group activities.* *j) Conclusion:* *Ask learners to mention what they have learned from the lesson and how they intend to apply it at home.* *k) Evaluation:* i. *Write three uses of money in a modern economy. (level 1)* ii. *Explain at least two characteristics of money. (level 2)* iii. *Discuss whether or not Ghana's currency is accepted as a legal tender. (level 3)* *l) Remarks:*	

PLC Session 8: Supporting the teaching and learning of numeracy at the right level in languages			
Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do and say during each session. Each bullet needs to be addressed	**Guidance notes on Leading the session.** *What the PLC Coordinator will have to say during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking teachers to share what they did differently in the classroom or elsewhere based on PLC Session 7, *on supporting the teaching and learning of numeracy at the right level in business studies*, which they think impacted learning positively. 1.2 Ask teachers to discuss and summarise why they think what a colleague did by way of application of lessons learned in Session 7, *on supporting the teaching and learning of numeracy at the right level in business studies*, supported learning.	1.1 Share what you did differently in the classroom or elsewhere based on PLC Session 7, *on supporting the teaching and learning of numeracy at the right level in business studies,* which you think impacted learning positively. 1.2 Discuss and summarise why you think what a colleague did by way of application of lessons learned in Session 7, *on supporting the teaching and learning of numeracy at the right level in business studies*, supported learning.	20 mins
2. Planning for teaching, learning and assessment activities, making links with the Pre-Tertiary (standards-	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	30 mins

based) Curriculum and using GESI, SEL, ICT and 21st century skills	Purpose: The purpose of the session is to discuss how to support the teaching and learning of numeracy at the right level in languages, and vice versa. LO1: Demonstrate knowledge and understanding of ways of applying numeracy in the teaching, learning and assessment of languages (NTS 2c - 2f, 3a and 3c – 3j) LI 1.1 Explain the concept of teaching languages at the right level, embedding numeracy. LI 1.2 Discuss ways of integrating numeracy into the planning, teaching, learning and assessment of languages curriculum. LO2: Demonstrate knowledge, understanding and application of language concepts to support the teaching and learning of numeracy (NTS 2c - 2f, 3a and 3c – 3m). LI 2.1 List three benefits of using languages to support the teaching and learning of numeracy. LI 2.2 Discuss the application of language concepts in the teaching and learning of numeracy. 2.2 Ask teachers to use think-pair-share to explain to their partners and share	Purpose: The purpose of the session is to discuss how to support the teaching and learning of numeracy at the right level in languages, and vice versa. LO1: Demonstrate knowledge and understanding of ways of applying numeracy in the teaching, learning and assessment of languages (NTS 2c - 2f, 3a and 3c – 3j). LI 1.1 Explain the concept of teaching languages at the right level, embedding numeracy. LI 1.2 Discuss ways of integrating numeracy into the planning, teaching, learning and assessment of languages curriculum. LO2: Demonstrate knowledge, understanding and application of language concepts to support the teaching and learning of numeracy (NTS 2c - 2f, 3a and 3c – 3m). LI 2.1 List three benefits of using languages to support the teaching and learning of numeracy. LI 2.2 Discuss the application of language concepts in the teaching and learning of numeracy. 2.2 Using think-pair-share, explain to your partner and share with the larger group	

	with the larger group the concept of numeracy at the right level in languages (NTS 2c, 3i). *E.g.* *a) It refers to the use of numerical concepts in language lessons taking into consideration the varied ability levels of the learners* *b) It refers to the use of logical reasoning in language lessons* *c) It refers to the identification of number sense by learners during a language lesson, etc.* 2.3 Ask teachers to discuss ways of integrating numeracy at the right level into the planning, teaching and learning of languages (NTS 2c - 2f, 3a and 3c – 3m). *E.g.* *a) Planning activities that require the use of numeracy registers (for instance, product, multiples, differentiation, fraction, etc.), and point out the meaning in a language context and that of a numeracy context* *b) Asking learners to give different meanings of some keywords in numeracy context to*	the concept of numeracy at the right level in languages (NTS 2c, 3i). *E.g.* *Numeracy at the right level in languages refers to the use of numerical concepts in language lessons taking into consideration the varied ability levels of the learners, etc.* 2.3 Discuss ways of integrating numeracy at the right level into the planning, teaching and learning of languages (NTS 2c - 2f, 3a and 3c – 3m). *E.g.* *Planning activities that require the use of numeracy registers (for instance, product, multiples, differentiation, fraction, etc.), and point out the meaning in a language context and that of numeracy context, etc.*	

	support a language lesson *c) Asking learners to count the number of keywords in a passage during a language lesson, etc.* 2.4 Ask teachers to explain at least two ways of integrating numeracy into the assessment of languages (NTS 3a, 3e, 3f, 3i and 3k – 3n). *E.g.* *a) Identifying the number of vowels in a word during a class project* *b) Determining the percentage of words in a paragraph that are verbs* *c) Typing a passage and turning on the word count feature on a computer to identify the number of words typed, etc.* 2.5 Ask teachers to list three benefits of using languages to support the teaching and learning of numeracy (NTS 2c, 2d). *E.g.* *a) It supports learners in practising how to organise data in charts* *b) It helps learners to build on numeracy registers* *c) It assists leaners to reason logically* *d) It helps learners to understand*	2.4 Explain at least two ways of integrating numeracy into the assessment of languages (NTS 3a, 3e, 3f, 3i and 3k – 3n). *E.g.* *Identifying the number of vowels in a word during a class project, etc.* 2.5 List three benefits of using languages to support the teaching and learning of numeracy (NTS 2c, 2d). *E.g.* *It supports learners in practising how to organise data in charts, etc.*	

	numerical concepts better *e) It supports learners' ability to interpret number sense. For instance, 'two', '2' and 'an image of two oranges', communicate the same meaning, etc.* 2.6 Ask teachers to discuss how language concepts will be applied in the teaching and learning of numeracy (NTS 2d, 3i). *E.g.* *a) In a numeracy lesson, learners will be asked to read word problems and later translate them into an algebraic expression or linear equation* *b) Numeracy registers will be explained both in numeracy contexts and language contexts for learners* *c) Learners will interpret statistical data orally or in writing* *d) Grammar and spellings will be checked in word problems to make sure learners use them rightly, etc.* 2.7 Ask teachers to discuss a sample lesson plan in English language and show how it can be taught with the support of numeracy for	2.6 Discuss how language concepts will be applied in the teaching and learning of numeracy (NTS 2d, 3i). *E.g.* *In a numeracy lesson, learners will be asked to read word problems and later translate them into an algebraic expression or linear equation, etc.* 2.7 Discuss a sample lesson plan in English language and show how it can be taught with the support of numeracy for learners who	

	learners who may struggle with identifying attributive adjectives (NTS 3e - 3l). *Refer to Appendix 8 for a sample lesson plan in English Language for SHS 1.*	may struggle with identifying attributive adjectives (NTS 3e - 3l). *Refer to Appendix 8 for a sample lesson plan in English Language for SHS 1.*	
	2.8 Ask teachers to indicate at least two other appropriate assessment methods that could be used to support the delivery of the lesson on attributive and predicative adjectives (NTS 3k, 3l). *E.g.* *a) Self-assessment* *b) Peer review* *c) Portfolio, etc.*	2.8 Indicate at least two other appropriate assessment methods that could be used to support the delivery of the lesson on attributive and predicative adjectives (NTS 3k, 3l). *E.g.* *Self-assessment, etc.*	
3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	3.1 Ask teachers to identify in the sample lesson plan, activities that could promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3f, 3g). *E.g.* *a) Learners were put into groups taking GESI into consideration (GESI/SEL)* *b) Teacher used mixed-gender groups (where possible) during the activities on key words to encourage collaboration between males and females including SEN learners (GESI/SEL/SEN/21st century skills)* *c) Teacher provided individual support to learners who struggled to identify*	3.1 Identify in the sample lesson plan, activities that could promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3f, 3g). *E.g.* *Learners were put into groups taking GESI into consideration, etc.*	30 mins

	features of a dog, hence taking levels of learning in their class into consideration (Differentiation) *d) Teacher used differentiated activities in the presentation of lesson to help take care of different ability groups (Differentiation)* *e) Teacher used projector to project the picture of a dog for learners to identify the features of the dog (ICT), etc.* 3.2 Ask teachers to recommend other appropriate strategies that could aid in the development of language using numeracy skills of learners who struggled with identifying adjectives (NTS 2d, 3e and 3g). *E.g.* *a) Asking learners to classify the faces of their pets according to colour, size and shape* *b) Asking learners in groups to mention their favourite pets, record the number of favourite pets and represent the information in a bar chart, etc.* 3.3 Ask teachers to explain how ICT can be used in	3.2 Recommend other appropriate strategies that could aid in the development of language using numeracy skills of learners who struggled with identifying adjectives (NTS 2d, 3e and 3g). *E.g.* *Asking learners to classify the faces of their pets according to colour, size and shape, etc.* 3.3 Explain how ICT can be used in assessing numeracy	

	assessing numeracy skills of learners in a language lesson (NTS 3j). *E.g.* *a) Tasking learners to compile words that start with letter "P" from a word bank and use Excel spreadsheet to find their percentage* *b) Giving learners assignments to represent pictorially, the types of adjectives and present in PowerPoint, etc.* 3.4 Ask a teacher to model a teaching activity based on the sample lesson plan that can support learners who may struggle with identifying adjectives, taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 3e – 3j). 3.5 Ask teachers to provide feedback on the modelled activity (NTS 1a, 3l).	skills of learners in a language lesson (NTS 3j). *E.g.* *Tasking learners to compile words that start with letter "P" from a word bank and use Excel spreadsheet to find their percentage, etc.* 3.4 Model a teaching activity based on the sample lesson plan that can support learners who may struggle with identifying adjectives, taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 3e – 3j). 3.5 Provide feedback on the modelled activity (NTS 1a, 3l).	
4. Evaluation and review of session: i. **Noting that teachers need to identify critical friends to observe lessons and report at next session**	4.1 Ask teachers in groups to reflect, write and share what they have learned with the larger group with regard to the concept and benefits of numeracy at the right level in languages (NTS 1a, 1b). 4.2 Remind teachers to, where possible, identify a critical friend to observe their lesson in relation to PLC Session 8 and provide	4.1 In your group, reflect, write and share what you have learned with the larger group with regard to the concept and benefits of numeracy at the right level in languages (NTS 1a, 1b). 4.2 Where possible, identify a critical friend to observe your lesson in relation to PLC Session 8 and provide feedback to you (NTS 1a, 3l and 3n).	10 mins

	feedback to them (NTS 1a, 3l and 3n). 4.3 Remind teachers to read PLC Session 9 in preparation for the next session.	 4.3 Read PLC Session 9 in preparation for the next session.	

Appendix 8	*A sample lesson plan for teaching English Language and show how it can be taught with the support of numeracy for learners who struggle with identifying attributive adjectives* *a) Aspect: Grammar* *b) Topic: Adjectives* *c) Sub-topic: Attributive and predicative adjectives* *d) Objectives: By the end of the lesson, the learner will be able to:* *i. Explain what an adjective is.* *ii. Define:* ➢ *Attributive adjective* ➢ *Predicative adjective* *iii. Use the adjectives appropriately in sentences.* *iv. Group adjectives identified in given sentences into attributive and predicative and draw a bar chart from data obtained.* *e) Relevant Previous Knowledge (RPK): Learners can identify and describe pets.* *f) Teaching Learning Resources (TLRs): Picture of a dog, pre-recorded audio on adjectives, graph sheets, computer and projector*	*A sample lesson plan for teaching English Language and show how it can be taught with the support of numeracy for learners who struggle with identifying attributive adjectives* *a) Aspect: Grammar* *b) Topic: Adjectives* *c) Sub-topic: Attributive and predicative adjectives* *d) Objectives: By the end of the lesson, the learner will be able to:* *i. Explain what an adjective is.* *ii. Define:* ➢ *Attributive adjective* ➢ *Predicative adjective* *iii. Use the adjectives appropriately in sentences.* *v. Group adjectives identified in given sentences into attributive and predicative and draw a bar chart from data obtained.* *e) Relevant Previous Knowledge (RPK): Learners can identify and describe pets.* *f) Teaching Learning Resources (TLRs): Picture of a dog, pre-recorded audio on adjectives, graph sheets, computer and projector*	

	g) *Reference: GES/MoE teaching syllabus for SHS 1(2012), AKI-OLA series* h) *Introduction: Put learners into mixed-gender/mixed-ability groups to discuss the external features of a dog from the picture projected. Task each group to choose one person to tally the features identified and share with the whole class.* i) *Discussion:* i. *Form mixed-ability/mixed-gender groups (where possible). Ask learners in their groups to identify and write at least two words that are used in the description which say something about features of a pet.* ii. *Learners count and document the number of identified features of the dog in the picture and represent them on a bar chart using graph sheets* iii. *Identify and support learners who have difficulty in recognising features of a dog to enable them identify and write at least one feature of the dog.* iv. *Play a pre-recorded video/audio on the types of adjectives*	g) *Reference: GES/MoE teaching syllabus for SHS 1(2012), AKI-OLA series* h) *Introduction: Put learners into mixed-gender/mixed-ability groups to discuss the external features of a dog from the picture projected. Task each group to choose one person to tally the features identified and share with the whole class.* i) *Discussion:* i. *Ask learners in their groups to identify and write at least 2 words that are used in the description which say something about features of a pet.* ii. *Learners count and document the number of identified features of the dog in the picture and represent them on a bar chart using graph sheets* iii. *Identify and support learners who have difficulty in recognising features of a dog to enable them identify and write at least one feature of the dog.* iv. *Play a pre-recorded video/audio on the types of adjectives*	

	and ask learners to listen attentively and write at least two types of adjectives they can remember for further discussion. *v. Based on the audio, ask learners in their various groups to write at least three key terms in the lesson and give their definitions (an adjective, attributive adjective and predicative adjective).* *j) Presentation:* *Teacher gives further explanations to all that the learners have discussed.* *k) Core points:* *i. An adjective is a word or a grammatical item that modifies, describes or gives further information about a noun or a pronoun.* *Some types of Adjectives* *✓ Attributive adjective* *✓ Predicative adjective* *ii. Attributive adjective is an adjective that appears before the noun or the pronoun it describes. For instance: The girl has <u>red</u> lips, etc.*	*and ask learners to listen attentively and write at least 2 types of adjectives they can remember for further discussion.* *v. Based on the audio, ask learners in their various groups to write at least three key terms in the lesson and give their definitions (an adjective, attributive adjective and predicative adjective).* *j) Presentation:* *Teacher gives further explanations to all that the learners have discussed.* *k) Core points:* *i. An adjective is a word or a grammatical item that modifies, describes or gives further information about a noun or a pronoun.* *Some types of Adjectives* *✓ Attributive adjective* *✓ Predicative adjective* *ii. Attributive adjective is an adjective that appears before the noun or the pronoun it describes. For instance: The girl has <u>red</u> lips, etc.*	

	iii. *Predicative adjective is an adjective that occurs after the noun or the pronoun it describes. For instance: The boy is <u>tall</u>, etc.* l) *Core Competencies:* i. *collaboration skills* ii. *leadership skills* iii. *critical thinking skills* iv. *digital literacy skills* m) *Conclusion:* *Conclude the lesson by asking the learners to reflect and mention at least two things they have learned in the lesson.* n) *Evaluation:* i. *What is an adjective? (Level 1)* ii. *Which of the following pair of adjectives were discussed in the lesson?* a. *comparative and superlative adjectives* b. *attributive and predicative adjectives* c. *demonstrative and possessive adjectives (Level 1)* iii. *Form two sentences each using "proud" and "beautiful"*	iii. *Predicative adjective is an adjective that occurs after the noun or the pronoun it describes. For instance: The boy is <u>tall</u>, etc.* l) *Core Competencies:* i. *collaboration skill* ii. *leadership skill* iii. *critical thinking skill* iv. *digital literacy skills* v. m) *Conclusion:* *Conclude the lesson by asking the learners to reflect and mention at least two things they have learned in the lesson.* n) *Evaluation:* i. *What is an adjective? (Level 1)* ii. *Which of the following pair of adjectives were discussed in the lesson?* a. *comparative and superlative adjectives* b. *attributive and predicative adjectives* c. *demonstrative and possessive adjectives (Level 1)* iii. *Form two sentences each using "proud" and "beautiful"*	

	attributively and predicatively. Present the sentences in a table form. (Level 2) *iv. Identify adjectives in the passage below. Calculate the percentage of the words that are attributive adjectives and the percentage that are predicative adjectives. (Level 3)* *Passage* *The chalkboard is by far the commonest teaching aid used at virtually all the levels of education- from the nursery to the university. The chalkboard used to be black, which was why the name "blackboard" stuck for ages; but today, there are boards of various <u>colours</u>: blue, green, even white. It is not easy to draw complex diagrams showing minute details, such as parts of the body, unless one is a good artist. Where one has succeeded with laborious illustrations, using different colours, it could be painful when the board has to be cleaned by the next teacher. However, there are nowadays various innovations, including foldable boards made of plywood which allow teachers more room to leave their materials for longer periods.* o) *Remarks:*	*attributively and predicatively. Present the sentences in a table form. (Level 2)* *iv. Identify adjectives in the passage below. Calculate the percentage of the words that are attributive adjectives and the percentage that are predicative adjectives. (Level 3)* *Passage* *The chalkboard is by far the commonest teaching aid used at virtually all the levels of education- from the nursery to the university. The chalkboard used to be black, which was why the name "blackboard" stuck for ages; but today, there are boards of various <u>colours</u>: blue, green, even white. It is not easy to draw complex diagrams showing minute details, such as parts of the body, unless one is a good artist. Where one has succeeded with laborious illustrations, using different colours, it could be painful when the board has to be cleaned by the next teacher. However, there are nowadays various innovations, including foldable boards made of plywood which allow teachers more room to leave their materials for longer periods.* o) *Remarks:*	

PLC Session 9: Supporting the teaching and learning of numeracy at the right level in science subjects			
Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do and say during each session. Each bullet needs to be addressed	**Guidance notes on Leading the session.** *What the PLC Coordinator will have to say during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking teachers to share what they did differently in the classroom or elsewhere based on PLC Session 8, on *supporting the teaching and learning of numeracy at the right level in languages*, which they think impacted learning positively. 1.2 Ask teachers to discuss and summarise in a single sentence why they think what a colleague did by way of application of what they learned in Session 8, on *supporting the teaching and learning of numeracy at the right level in languages,* supported learning.	1.1 Share what you did differently in the classroom or elsewhere based on PLC Session 8, on *supporting the teaching and learning of numeracy at the right level in languages*, which you think impacted learning positively. 1.2 Discuss and summarise in a single sentence why you think what your colleague did by way of application of what they learned in Session 8, on *supporting the teaching and learning of numeracy at the right level in languages,* supported learning.	20 mins
2. Planning for teaching, learning and assessment activities, making	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	30 mins

links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	**Purpose:** The purpose of this session is to discuss concepts that support the teaching and learning of numeracy at the right level in science subjects, and vice versa. LO 1: Demonstrate knowledge, understanding and application of relevant concepts in science at the right level to support the acquisition of numeracy skills (NTS 2a – 2c, 2e and 2f). LI 1.1 Identify concepts in science that can promote the acquisition of numeracy skills at the right level. LI 1.2 Analyse at least a concept in science that can be used to support the acquisition of numeracy skills at the right level. LO 2: Demonstrate knowledge, understanding and application of numeracy in planning, teaching and assessing science lessons (NTS 2a – 2c, 2e and 2f). LI 2.1 Outline at least one strategy and benefit of using numeracy in the planning and teaching of science lessons. LI 2.2 Discuss at least one assessment tool that can be used to assess science concepts using numeracy.	**Purpose:** The purpose of this session is to discuss concepts that support the teaching and learning of numeracy at the right level in science subjects, and vice versa. LO 1: Demonstrate knowledge, understanding and application of relevant concepts in science at the right level to support the acquisition of numeracy skills (NTS 2a – 2c, 2e and 2f). LI 1.1 Identify concepts in science that can promote the acquisition of numeracy skills at the right level. LI 1.2 Analyse at least a concept in science that can be used to support the acquisition of numeracy skills at the right level. LO 2: Demonstrate knowledge, understanding and application of numeracy in planning, teaching and assessing science lessons (NTS 2a – 2c, 2e and 2f). LI 2.1 Outline at least one strategy and benefit of using numeracy in the planning and teaching of science lessons. LI 2.2 Discuss at least one assessment tool that can be used to assess science concepts using numeracy.	

	2.2 Ask teachers in subject groups to identify concepts in any domain in science that can promote the acquisition of numeracy skills (NTS 3i). *E.g.* *a) Concepts in biology:* *i. Ecology (sampling)* *ii. Respiration (equation)* *iii. Photosynthesis (equation), etc.* *b) Concepts in chemistry:* *i. Balancing of chemical equations (equations)* *ii. Titration (measurement and calculations)* *iii. Mole concept (calculations), etc.* *c) Concepts in physics:* *i. Temperature (measurement and calculations)* *ii. Force (calculations)* *iii. Measurement of physical quantities (measurement and calculations), etc.* 2.3 Ask teachers in their science domain groups to analyse at least one concept in science that can be used to support the acquisition of numeracy skills at the right level (NTS 2b, 2c). *E.g.* *In physics, work is said to be done when a force moves from its point of application through a distance in the direction of the force.*	2.2 In your subject groups, identify concepts in any domain in science that can promote the acquisition of numeracy skills (NTS 3i). *E.g.* *a) Concepts in biology: Ecology (sampling), etc.* *b) Concepts in chemistry: Balancing of chemical Equations (equation), etc.* *c) Concepts in physics: Temperature (measurement and calculations), etc.* 2.3 In your science domain groups, analyse at least one concept in science that can be used to support the acquisition of numeracy skills at the right level (NTS 2b, 2c). *E.g.* *In physics, work is said to be done when a force moves its point of application through a distance in the direction of the force.*	

	For instance, during braking, a force of 200 newton (N) is applied to the brake of a car, the car takes 20 metres (m) to come to a stop. Calculate the work done. *Solution: Force (F) = 200N* *Distance (d) = 20m* *Work done (Wd) = Force (F) ×Distance (d)* *Wd = F×d* *Wd = 200N×20m = 4000J/4000Nm, etc.* 2.4 Ask teachers to discuss at least three benefits of numeracy skills in the teaching and learning of scientific concepts (NTS 2b - 2f, 3a and 3f - 3j). *E.g.* *a) The skill of computation attained in numeracy can help learners to have a better understanding of science concepts that involve calculations. For instance, the concepts of 'force', 'temperature', etc.* *b) Logical reasoning skills acquired in numeracy can help learners to think analytically in solving science related problems*	*For instance, during braking, a force of 200 newton (N) is applied to the brake of a car, the car takes 20 metres (m) to come to a stop. Calculate the work done.* *Solution:* *Force (F) = 200N* *Distance (d) = 20m* *Work done (Wd) = Force (F) x Distance (d)* *Wd = F×d* *Wd = 200N×20m = 4000J/4000Nm, etc.* 2.4 Discuss at least three benefits of numeracy skills in the teaching and learning of scientific concepts (NTS 2b - 2f, 3a and 3f - 3j). *E.g.* *The skill of computation attained in numeracy can help learners to have a better understanding of science concepts that involve calculations. For instance, the concepts of 'force' and 'temperature', etc.*	

	c) Sorting skills acquired in numeracy can help learners to categorise the number of hydrogen and oxygen atoms in a balanced chemical equation *d) Numeracy skills acquired in basic statistics can help learners to analyse and interpret data in scientific concepts, etc.* 2.5 Ask teachers to discuss one assessment tool that can be used to assess scientific concepts (NTS 3k - 3p). *E.g.* *a) Test:* *Test is a set of items, questions, prompts or tasks that measure learners' thinking abilities and exam preparations. There can be different types and categories depending on the subject, level and purpose of the assessment. An example of a test item is a multiple-choice test. Multiple choice tests are tests in which each item has a stem followed by options (alternatives) from which the respondent selects what he/she considers as the option that best completes or answers the stem. Such questions are*	2.5 Discuss one assessment tool that can be used to assess scientific concepts (NTS 3k - 3p). *E.g.* *Test:* *Test is a set of items, questions, prompts or tasks that measure learners' thinking abilities and exam preparations. There can be different types and categories depending on the subject, level and purpose of the assessment. An example of a test item is a multiple-choice test. Multiple choice tests are tests in which each item has a stem followed by options (alternatives) from which the respondent selects what he/she considers as the option that best completes or answers the stem. Such questions are*	

	normally composed of four parts: *i. Stem-question or incomplete statement* *ii. Options- suggested answers or completions* *iii. Distracters/Foils- incorrect responses* *iv. Key- correct responses* *There are rubrics that govern the construction of multiple-choice questions. For instance, the distractors should all be plausible to the uninformed.* *Poor test item:* *In an experiment to test for starch in a leaf, which one of the following reasons best explains why the leaf is boiled?* *a. For the leaf to become wrinkled* *b. To kill the cells of the leaf* *c. For the leaf to change its colour* *d. To enable the leaf to be carried easily* *Good test item:* *In an experiment to test for starch in a leaf, which one of the following reasons best explains why the leaf is boiled? To…* *a. kill the cells of the leaf and stop all chemical reactions.* *b. soften the cells of the leaf and makes its watery.*	*normally composed of four parts:* *i. Stem-question or incomplete statement* *ii. Options- suggested answers or completions* *iii. Distracters/Foils- incorrect responses* *iv. Key- correct responses* *There are rubrics that govern the construction of multiple-choice questions. For instance, the distractors should all be plausible to the uninformed.* *Poor test item:* *In an experiment to test for starch in a leaf, which one of the following reasons best explains why the leaf is boiled?* *a. For the leaf to become wrinkled* *b. To kill the cells of the leaf* *c. For the leaf to change its colour* *d. To enable the leaf to be carried easily* *Good test item:* *In an experiment to test for starch in a leaf, which one of the following reasons best explains why the leaf is boiled? To…* *a. kill the cells of the leaf and stop all chemical reactions.* *b. soften the cells of the leaf and makes it watery.*	

	c. *soften the cells of the leaf and make it wrinkled.* d. *stop all chemical reactions taking place in the leaf.* b) *Checklist:* *Checklist is a tool that states specific criteria and allow learners to gather information and to make judgements about what learners know and can do in relation to learning outcomes. They offer systematic ways of collecting data about specific behaviours, knowledge and skills* c) *Subject Portfolio:* *Subject portfolio is the deliberate collection of learners' work that has been selected and organised for a particular subject to show learner's learning and progress to achieving the learning outcomes through examples of his or her best work, etc.* 2.6 Ask teachers to discuss a sample lesson plan in integrated science and show how it can be taught to promote numeracy skills at the right level to learners who may struggle with the concept of photosynthesis (NTS 2b, 2e, 2f and 3c - 3p).	c. *soften the cells of the leaf and make it wrinkled.* d. *stop all chemical reactions taking place in the leaf.* 2.6 Discuss a sample lesson plan in integrated science and show how it can be taught to promote numeracy skills at the right level to learners who may struggle with the concept of photosynthesis (NTS 2b, 2e, 2f and 3c - 3p).	
	Refer to Appendix 9 for a sample lesson plan in	*Refer to Appendix 9 for a sample lesson plan in*	

	integrated science for SHS 1 (Basic 10) 2.7 Ask teachers to indicate how the lesson will be assessed using other appropriate assessment methods (NTS 3k – 3p). *E.g.* *a) Class exercise* *b) Subject portfolio* *c) Enquiry* *d) Test/quiz* *e) Exams, etc.*	*integrated science for SHS 1 (Basic 10)* 2.7 Indicate how the lesson will be assessed using other appropriate assessment methods (NTS 3k – 3p). *E.g.* *Class exercise, etc.*	
3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	3.1 Ask teachers to identify in the sample lesson plan, activities that could promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3f). *E.g.* *a) Learners worked in pairs, mixed-gender and mixed-ability groups to perform an experiment on how to test for starch in a leaf after watching a video on it (GESI/ICT)* *b) Learners worked in pairs and in mixed-gender groups which encouraged collaboration between males and females including SEN learners (SEL/GESI/21st century skills)* *c) Teacher provided individualised support to learners who struggled with the steps involved in how to test for starch in a leaf (SEL/Differentiation)*	3.1 Identify in the sample lesson plan activities that could promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3f). *E.g.* *Learners worked in pairs, mixed-gender and mixed-ability groups to perform an experiment on how to test for starch in a leaf after watching a video on it, etc.*	30 mins

	d) *Differentiated activities for level 1, 2 and 3 learners on how to test for starch in a leaf were provided (Differentiation)* 3.2 Ask teachers to show how ICT can be used in assessing concepts in integrated science to promote numeracy skills at the right level (NTS 3j). *E.g.* a) *Watching YouTube/Pre-recorded videos and podcast on how photosynthesis occurs and write a balanced chemical equation for it* b) *Giving learners assignments on the steps involved in how to test for starch in a leaf to be presented in PowerPoint* c) *Giving learners projects to search online for information on how photosynthesis takes place and its chemical equation* d) *Using rating scale to determine the atom that occurs most in the balanced chemical equation of photosynthesis, etc.* 3.3 Ask a teacher to model a teaching activity based on the sample lesson plan that can	3.2 Show how ICT can be used in assessing concepts in integrated science to promote numeracy skills at the right level (NTS 3j). *E.g.* *Watching YouTube/Pre-recorded videos and podcast on how photosynthesis occurs and write a balanced chemical equation for it, etc.* 3.3 Model a teaching activity based on the sample lesson plan that can support learners who may struggle with concepts in photosynthesis for feedback from your colleagues taking into consideration GESI, SEL, ICT, 21st century skills and	

	support learners who may struggle with concepts in photosynthesis for feedback from their colleagues taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 2c and 3e).	differentiation (NTS 1a, 2c and 3e).	
4. Evaluation and review of session: i. Noting that teachers need to identify critical friends to observe lessons and report at next session	4.1 Ask teachers in groups to reflect, write and share what they have learned with the larger group with regard to the concept of supporting the teaching and learning of numeracy at the right level in science subjects (NTS 1a, 1b). 4.2 Remind teachers to identify a critical friend (where possible) to observe their lesson in relation to PLC Session 9 and provide feedback to them (NTS 2e, 3a and 3h). 4.3 Remind teachers to read and bring along any relevant materials for PLC Session 10 in preparation for the next session.	4.1 In your group, reflect, write and share what you have learned with the larger group with regard to the concept of supporting the teaching and learning of numeracy at the right level in science subjects (NTS 1a, 1b). 4.2 Identify a critical friend (where possible) to observe your lesson in relation to PLC Session 9 and provide feedback to you (NTS 2e, 3a and 3h). 4.3 Read and bring along any relevant materials for PLC Session 10 in preparation for the next session.	10 mins
Appendix 9	*A sample lesson plan that s*upports the teaching and learning of numeracy at the right level in science subjects*:* *a) Topic: Energy* *b) Sub-topic: Photosynthesis* *c) Objectives: By the end of the lesson, the learner will be able to:*	*A sample lesson plan that s*upports the teaching and learning of numeracy at the right level in science subjects*:* *a) Topic: Energy* *b) Sub-topic: Photosynthesis* *c) Objectives: By the end of the lesson, the learner will be able to:*	

	i. *Explain the term photosynthesis correctly* ii. *Demonstrate how to test for starch in a leaf* iii. *Write a balanced chemical equation that summarises the process of photosynthesis and identify the number of hydrogen, carbon and oxygen atoms at the reactant and product sides of the equation* d) *Teaching and Learning Resources (TLRs): YouTube videos on how photosynthesis occurs, projector, laptop/computer, water-bath, beaker, dropping pipette, petri-dish, ethanol, water, bunsen burner, lighter, leaf of talinum triangulare (water leaf)/periwinkle, iodine solution and test tubes.* e) *Relevant Previous Knowledge (RPK): Learners eat every day and prepare food. Learners also see leaves of plants in their environment.* f) *Introduction: Revise learners' RPK through questions and answers. For instance, what process makes it possible for plants to manufacture their own food?(Expected Answers-*	i. *Explain the term photosynthesis correctly* ii. *Demonstrate how to test for starch in a leaf* iii. *Write a balanced chemical equation that summarises the process of photosynthesis and identify the number of hydrogen, carbon and oxygen atoms at the reactant and product sides of the equation* d) *Teaching and Learning Resources (TLRs): YouTube videos on how photosynthesis occurs, projector, laptop/computer, water-bath, beaker, dropping pipette, petri-dish, ethanol, water, bunsen burner, lighter, leaf of talinum triangulare (water leaf)/periwinkle, iodine solution and test tubes.* e) *Relevant Previous Knowledge (RPK): Learners eat every day and prepare food. Learners also see leaves of plants in their environment.* f) *Introduction: Revise learners' RPK through questions and answers. For instance, what process makes it possible for plants to manufacture their own food?(Expected*	

	Photosynthesis, rainfall and sunlight) *Note:* *Share specific objectives with learners* *g) Tasks/Activities:* *Activity 1:* *Learners, after watching a video on photosynthesis, think-pair-share its meaning. Guide learners to explain the meaning of the term photosynthesis.* *Activity 2:* *Learners work individually and in mixed-ability groups to perform the activity of testing for starch in a leaf.* *Step 1:* *Place a potted plant of <u>Talinum</u> <u>trangulare</u> (waterleaf) under the sun for about three (3) hours* *Step 2:* *Pluck one leaf and place it in a water bath to boil for about five (5) minutes (this is meant to kill the cells of the leaf, soften it and stop all chemical reactions taking place)* *Step 3:* *Remove the leaf from the water-bath and place it in a test tube containing 70% ethanol and place the test tube in a water bath for the ethanol to simmer for about three*	*Answers- Photosynthesis, rainfall and sunlight)* *Note:* *Share specific objectives with learners* *g) Tasks/Activities:* *Activity 1:* *Learners, after watching a video on photosynthesis, think-pair-share its meaning. Guide learners to explain the meaning of the term photosynthesis.* *Activity 2:* *Learners work individually and in mixed-ability groups to perform the activity of testing for starch in a leaf.* *Step 1:* *Place a potted plant of <u>Talinum</u> <u>trangulare</u> (waterleaf) under the sun for about three (3) hours* *Step 2:* *Pluck one leaf and place it in a water bath to boil for about five (5) minutes (this is meant to kill the cells of the leaf, soften it and stop all chemical reactions taking place)* *Step 3:* *Remove the leaf from the water-bath and place it in a test tube containing 70% ethanol and place the test tube in a water bath for the ethanol to simmer for about three (3) minutes*	

	(3) minutes (this is to decolourise the leaf) *Step 4:* *Remove the leaf from the test tube and wash it gently in a hot water to soften it and finally place it on a petri-dish.* *Step 5:* *With the help of a dropping pipette, place few drops of the iodine solution on the leaf and observe.* *Observation:* *Learners will observe that the leaf turns blue-black.* *Conclusion:* *The blue-black colouration indicates the presence of starch in the leaf.* *Note:* *Questions that can promote the acquisition of numeracy skills* *i. How many test tubes were used in the experiment?* *ii. If one leaf took five minutes to boil, how many minutes will take three leaves to boil?* *Activity 3:* *Learners write a balanced chemical equation that summarises the process of photosynthesis from its definition.* *h) Core Points:* *i. Keywords:* ✓ *Photosynthesis* ✓ *Iodine solution* ✓ *Chlorophyll* ✓ *Starch*	*(this is to decolourise the leaf)* *Step 4:* *Remove the leaf from the test tube and wash it gently in a hot water to soften it and finally place it on a petri-dish.* *Step 5:* *With the help of a dropping pipette, place few drops of the iodine solution on the leaf and observe.* *Observation:* *Learners will observe that the leaf turns blue-black.* *Conclusion:* *The blue-black colouration indicates the presence of starch in the leaf.* *Note:* *Questions that can promote the acquisition of numeracy skills* *i. How many test tubes were used in the experiment?* *ii. If one leaf took five minutes to boil, how many minutes will take three leaves to boil?* *Activity 3:* *Learners write a balanced chemical equation that summarises the process of photosynthesis from its definition.* *h) Core Points:* *i. Keywords:* ✓ *Photosynthesis* ✓ *Iodine solution* ✓ *Chlorophyll* ✓ *Starch*	

	✓ *Dropping pipette* *ii. Explanation of the term photosynthesis: Photosynthesis is the process whereby simple inorganic substances such as carbon di-oxide and water are combined in the presence of sunlight and chlorophyll to form an organic food complex (glucose) and oxygen is given out as a by-product.* *iii. The chemical equation that summarise the process of photosynthesis:* *Sunlight* $6CO_2+6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$ *Chlorophyll* *i) Core Competencies:* *i. Problem-solving skills* *ii. Critical thinking* *iii. Collaborative learning* *iv. Communication skills* *v. Leadership skills* *j) Conclusion:* *i. Draw learners' attention to the end of the lesson.* *ii. Summarize the lesson by asking learners in their groups to tell what they have learnt* *iii. Give exercise, mark and provide*	✓ *Dropping pipette* *ii. Explanation of the term photosynthesis: Photosynthesis is the process whereby simple inorganic substances such as carbon di-oxide and water are combined in the presence of sunlight and chlorophyll to form an organic food complex (glucose) and oxygen is given out as a by-product.* *iii. The chemical equation that summarise the process of photosynthesis:* *Sunlight* $6CO_2+6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$ *Chlorophyll* *i) Core Competencies:* *i. Problem-solving skills* *ii. Critical thinking* *iii. Collaborative learning* *iv. Communication skills* *v. Leadership skills* *j) Conclusion:* *i. Draw learners' attention to the end of the lesson.* *ii. Summarize the lesson by asking learners in their groups to tell what they have learnt* *iii. Give exercise, mark and provide*	

	feedback to the learners individually *iv. Assign an activity for the next lesson* *Tasks for the various levels* *i. Learners identify and sort out at least five resources that can be used when testing for starch in a leaf (Level 1)* *ii. Learners further demonstrate how to test for starch in a leaf and explain the processes at each stage of the experiment (Level 2)* *iii. Additionally, learners write and balance a chemical equation that summarises the process of photosynthesis (Level 3)* *k) Evaluation:* *i. Explain the term photosynthesis.* *ii. Outline at least three (3) steps involved in testing for starch in a leaf and give reason(s):* ➢ *Why the leaf was boiled for five (5) minutes?* ➢ *Why the leaf was allowed to simmer in the ethanol for three (3) minutes?* *iii. Write a balanced chemical equation that*	*feedback to the learners individually* *iv. Assign an activity for the next lesson* *Tasks for the various levels* *i. Learners identify and sort out at least five resources that can be used when testing for starch in a leaf (Level 1)* *ii. Learners further demonstrate how to test for starch in a leaf and explain the processes at each stage of the experiment (Level 2)* *iii. Additionally, learners write and balance a chemical equation that summarises the process of photosynthesis (Level 3)* *k) Evaluation:* *i. Explain the term photosynthesis.* *ii. Outline at least three (3) steps involved in testing for starch in a leaf and give reason(s):* ➢ *Why the leaf was boiled for five (5) minutes?* ➢ *Why the leaf was allowed to simmer in the ethanol for three (3) minutes?* *iii. Write a balanced chemical equation that summarises the*	

	summarises the process of photosynthesis. *iv. What is the total number of oxygen atoms in the balanced chemical equation?* *v. How many principal and by-products were formed in the balanced chemical equation?* *vi. Represent the information from iv and v on a bar graph.* *l) Remarks:*	*process of photosynthesis.* *iv. What is the total number of oxygen atoms in the balanced chemical equation?* *v. How many principal and by-products were formed in the balanced chemical equation?* *vi. Represent the information from iv and v on a bar graph.* *l) Remarks:*	

PLC Session 10: Supporting the teaching and learning of numeracy at the right level in the social sciences			
Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do and say during each session. Each bullet needs to be addressed	**Guidance notes on Leading the session.** *What the PLC Coordinator will have to say during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking teachers to share what they did differently in the classroom or elsewhere based on PLC Session 9, on *supporting the teaching and learning of numeracy at the right level in science subjects*, which they think impacted learning positively. 1.2 Ask teachers to discuss and summarise in a single sentence why they think what a colleague did by way of application of what they learned in Session 9, on *supporting the teaching and learning of numeracy at the right level in science subjects*, supported learning.	1.1 Share what you did differently in the classroom or elsewhere based on PLC Session 9, on *supporting the teaching and learning of numeracy at the right level in science subjects,* which you think impacted learning positively. 1.2 Discuss and summarise in a single sentence why you think what your colleague did by way of application of what they learned in Session 9, on *supporting the teaching and learning of numeracy at the right level in science subjects*, supported learning.	20 mins
2. Planning for teaching, learning and assessment activities, making links with the Pre-Tertiary	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	30 mins

(standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	**Purpose:** The purpose of the session is to discuss how to support the teaching and learning of numeracy at the right level in the social sciences, and vice versa. LO 1: Demonstrate knowledge, understanding and application of the social sciences in the development of numeracy skills (NTS 2c – 2f, 3e and 3j). LI 1.1 Give at least two examples of how the social sciences can be used to support the teaching and learning of numeracy skills. LI 1.2 Analyse ways of applying the social sciences to support the development of numeracy skills. LO 2: Demonstrate knowledge, understanding and application of numeracy skills in supporting the teaching and learning of the social sciences (NTS 2c – 2f, 3e and 3j). LI 2.1 Identify at least three numeracy skills that can be used to support the teaching and learning of the social sciences. LI 2.2 Explain at least three ways numeracy skills can support the teaching and learning of the social sciences. 2.2 Ask teachers to give at least two examples of how	**Purpose:** The purpose of the session is to discuss how to support the teaching and learning of numeracy at the right level in the social sciences, and vice versa. LO 1: Demonstrate knowledge, understanding and application of the social sciences in the development of numeracy skills (NTS 2c – 2f, 3e and 3j). LI 1.1 Give at least two examples of how the social sciences can be used to support the teaching and learning of numeracy skills. LI 1.2 Analyse ways of applying the social sciences to support the development of numeracy skills. LO 2: Demonstrate knowledge, understanding and application of numeracy skills in supporting the teaching and learning of the social sciences (NTS 2c – 2f, 3e and 3j). LI 2.1 Identify at least three numeracy skills that can be used to support the teaching and learning of the social sciences. LI 2.2 Explain at least three ways numeracy skills can support the teaching and learning of the social sciences. 2.2 Give at least two examples of how the social	

	the social sciences can be used to support the teaching and learning of numeracy skills (NTS 2c, 2d, 3e and 3k). *E.g.* *a) Concepts in the social sciences such as map work, inflation, population, demand and supply, etc. provide opportunities for the development and application of numeracy skills* *b) Data from the social sciences such as voting records, opinion polls, maps and economic indicators could be used to support the development and application of numeracy skills* *c) Social science enquiry tools such as interviews, experiments, opinionnaires, field observations and surveys can support the development of numeracy skills, etc.* 2.3 Ask teachers to analyse ways of applying the social sciences to support the development of numeracy skills (NTS 1a, 2b, 2d, 2e and 3i). *E.g.* *a) Some social science concepts such as inflation, map work, demand and supply naturally have numeracy embedded*	sciences can be used to support the teaching and learning of numeracy skills (NTS 2c, 2d, 3e and 3k). *E.g.* *Concepts in the social sciences such as map work provide opportunities for the development and application of numeracy skills, etc.* 2.3 Analyse ways of applying the social sciences to support the development of numeracy skills (NTS 1a, 2b, 2d, 2e and 3i). *E.g.* *Some social science concepts such as inflation naturally have numeracy embedded in them, therefore direct*	

	in them, therefore direct teaching of such concepts develops numeracy skills *b) Data from the social sciences such as voting records, opinion polls, maps, economic indicators could be given to learners to manipulate through counting, adding, subtracting, dividing and representing to develop their numeracy skills* *c) Social science enquiry tools such as interviews, experiments, opinionnaires and field observations used to collect data can facilitate the development of counting, measuring, sorting, adding and other numeracy skills, etc.* 2.4 Ask teachers to identify at least three numeracy skills that can be used to support the teaching and learning of the social sciences (NTS 1a, 2b, 2d, 2e and 3i). *E.g.* *a) Arithmetic operations* *b) Counting* *c) Seriation* *d) Measuring* *e) Representation, etc.* 2.5 Ask teachers to explain at least three ways	*teaching of such concepts develops numeracy skills, etc.* 2.4 Identify at least three numeracy skills that can be used to support the teaching and learning of the social sciences (NTS 1a, 2b, 2d, 2e and 3i). *E.g.* *Arithmetic operations, etc.* 2.5 Explain at least three ways numeracy skills can	

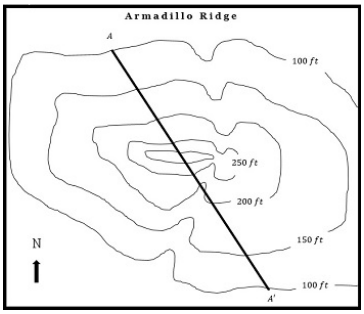
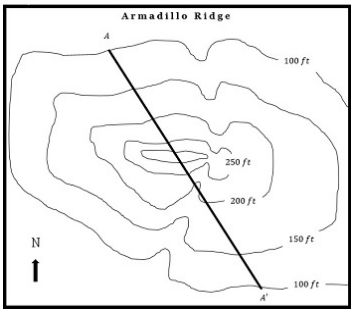
	numeracy skills can support the teaching and learning of the social sciences (NTS 1a, 2b, 2d, 2e and 3i). *E.g.* *a) Using representation (graphs, maps, patterns, etc.) for illustrations* *b) Using arithmetic operations (addition, subtraction, division, multiplication, etc.) to compute distances, values and other data* *c) Applying measuring skills to take coordinates, read maps, measure quantities, etc.* *d) Applying geometrical knowledge in illustrations such as demand/supply curves, maps, charts, etc.* 2.6 Ask teachers to discuss the sample lesson plan in Geography and show how it can be taught to develop numeracy skills in learners (NTS 3e - 3l).	support the teaching and learning of the social sciences (NTS 1a, 2b, 2d, 2e and 3i). *E.g.* *Using representation (graphs, maps, etc.) for illustrations, etc.* 2.6 Discuss the sample lesson plan in Geography and show how it can be taught to develop numeracy skills in learners (NTS 3e - 3l).	

	Refer to Appendix 10 for a sample lesson plan in the social sciences (Geography) 2.7 Ask teachers to indicate how the lesson will be assessed using other appropriate methods (NTS 1a, 3k - 3n). *E.g.* *a) Project works* *b) Peer assessment* *c) Class assignments* *d) Quizzes* *e) Case studies, etc.*	*Refer to Appendix 10 for a sample lesson plan in the social sciences (Geography)* 2.7 Indicate how the lesson will be assessed using other appropriate methods (NTS 1a, 3k - 3n). *E.g.* *Project works, etc.*	
3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	3.1 Ask teachers to identify strategies in the sample lesson plan that could promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3f). *E.g.* *a) Learners were encouraged to move around the class to give 'high five' to their colleagues (GESI/SEL)* *b) Learners were encouraged to reach out to their colleagues especially SEN learners to avoid them feeling left out of the activity (GESI/SEL)* *c) Topographical maps that are very clear to enhance learners' viewing were provided and projected (ICT/GESI)* *d) Mixed-ability groups were used in the lesson (GESI/SEL/21st century skills)*	3.1 Identify strategies in the sample lesson plan that could promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3f). *E.g.* *Learners were encouraged to move around the class to give 'high five' to their colleagues, etc.*	30 mins

	e) *Enough time was provided for learners to work at appropriate pace (GESI/SEL)* f) *Differentiated assessment was provided to cater for all levels of learners (Differentiation), etc.* 3.2 Ask teachers to recommend other appropriate assessment strategies that could aid in the development of numeracy skills in learners (NTS 1a, 2e, 3f and 3m). *E.g.* a) *Peer assessment* b) *Playing number games (cards, ludo, dominoes, etc.)* c) *Number riddles* d) *Maths quiz, etc.* 3.3 Ask teachers to indicate ways ICT can be used in assessing numeracy skills in learners (NTS 3j, 3k). *E.g.* a) *Using ICT application tools such as google forms, socrative, kahoot and mentimeter to build numeracy related tasks to assess learners* b) *Giving learners data that require the use of ICT tools such as spreadsheets and calculators to compute*	3.2 Recommend other appropriate assessment strategies that could aid in the development of numeracy skills in learners (NTS 1a, 2e, 3f and 3m). *E.g.* *Peer assessment, etc.* 3.3 Indicate ways ICT can be used in assessing numeracy skills in learners (NTS 3j, 3k). *E.g.* *Using ICT application tools such as google forms and socrative to build numeracy related tasks to assess learners, etc.*	

	c) *Engaging learners in playing mathematical game applications such as Solitaire, Sudoku and 2048 to assess numeracy skills, etc.* 3.4 Ask a teacher to model a teaching activity based on the sample lesson plan that can support learners who may struggle with practical skills in reading maps at the appropriate level, taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 2c, 2e, 2f and 3e - 3j). 3.5 Ask teachers to provide feedback on the lesson observed (NTS 3n, 3o).	3.4 Model a teaching activity based on the sample lesson plan that can support learners who may struggle with practical skills in reading maps at the appropriate level, taking into consideration GESI, SEL, ICT, 21st century skills and differentiation (NTS 1a, 2c, 2e, 2f and 3e - 3j). 3.5 Provide feedback on the lesson observed (NTS 3n, 3o).	
5. Evaluation and review of session: v. **Noting that teachers need to identify critical friends to observe lessons and report at next session**	4.1 Ask teachers in groups to reflect, write and share what they have learned with the larger group with regard to supporting the teaching and learning of numeracy at the right level in the social sciences (NTS 1a, 1b). 4.2 Remind teachers to, where possible, identify a critical friend to observe their lesson in relation to PLC Session 10 and provide feedback to them (NTS 1a, 1b). 4.3 Remind teachers to read PLC Session 11 in preparation for the next session.	4.1 In your group, reflect, write and share what you have learned with the larger group with regard to supporting the teaching and learning of numeracy at the right level in the social sciences (NTS 1a, 1b). 4.2 Where possible, identify a critical friend to observe your lesson in relation to PLC Session 10 and provide feedback to you (NTS 1a, 1b). 4.3 Read PLC Session 11 in preparation for the next session.	10 mins

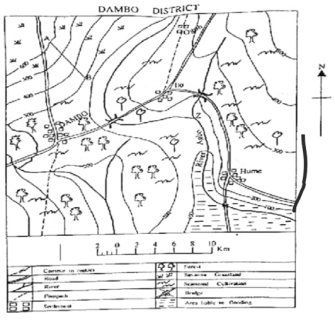
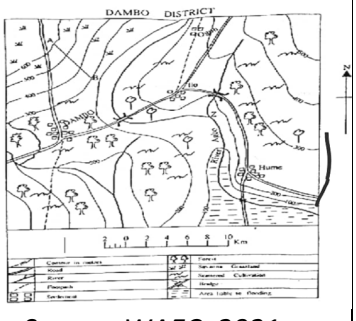
Appendix 10	*A sample lesson plan for the development of learner's numeracy skills in the teaching and learning of Geography:* *a) Topic:* *Principles of Map Reading* *b) Sub-Topic:* *Practical skills to demonstrate map reading* *c) Objectives:* *By the end of the lesson, the learner will be able to:* *i. Reduce a topographical map by a given scale factor.* *ii. Enlarge a topographical map by a given scale factor.* *iii. Draw a cross-section of a topographical map.* *d) Teaching and Learning Resources (TLRs):* *Computer, projector, topographical maps, metre rule, graph sheets, etc.* *e) Relevant Previous Knowledge (RPK):* *Learners can identify features on a topographical map.* *f) Introduction:* *i. Start the lesson by asking learners to move round the class to give a 'high five' to at least 5 colleagues they have not interacted*	*A sample lesson plan for the development of learner's numeracy skills in the teaching and learning of Geography:* *a) Topic:* *Principles of Map Reading* *b) Sub-Topic:* *Practical skills to demonstrate map reading* *c) Objectives:* *By the end of the lesson, the learner will be able to:* *i. Reduce a topographical map by a given scale factor.* *ii. Enlarge a topographical map by a given scale factor.* *iii. Draw a cross-section of a topographical map.* *d) Teaching and Learning Resources (TLRs):* *Computer, projector, topographical maps, metre rule, graph sheets, etc.* *e) Relevant Previous Knowledge (RPK):* *Learners can identify features on a topographical map.* *f) Introduction:* *i. Start lesson by asking learners to move round the class to give a 'high five' to at least 5 colleagues they have not*	

	with in the day. Encourage learners to reach out to especially SEN learners in the class to avoid them feeling left out of the activity. *ii. In an all-inclusive class discussion, learners mention some basic features of a topographical map.* *g) Tasks/Activities:* *i. Present topographical map sheets to learners and project a soft copy on a screen/board. Guide learners using structuring-talk- for learning strategy to discuss the steps involved in reducing a map by a given scale factor.* *Note:* *Ensure the features on the topographical sheets are very clear to enhance learner's viewing.*  	*interacted with in the day. Encourage learners to reach out to especially SEN learners in the class to avoid them feeling left out of the activity.* *ii. In an all-inclusive class discussion, learners mention some basic features of a topographical map.* *g) Tasks/Activities:* *i. Present topographical map sheets to learners and project a soft copy on a screen/board. Guide learners using structuring-talk- for learning strategy to discuss the steps involved in reducing a map by a given scale factor.* *Note:* *Ensure the features on the topographical sheets are very clear to enhance learner's viewing.*  	

	ii. *In mixed-ability and mixed-gender groups, task learners to apply knowledge in reducing a topographical map to enlarge a part of the map by a given scale factor. Move round to provide support for learners in need.* iii. *Guide leaners as they work in pairs, to use the appropriate tools such as rulers, pencils, and pens to mark the key features between two points of a topographical map for cross sectional drawing. Provide enough time for learners to work at appropriate pace and scaffold/support when necessary.* *Level 1: Construct a cross section with the elevations recorded.* *Level 2: Construct a cross section with elevations recorded and appropriate annotations provided.* *Level 3: Construct a cross section with*	ii. *In mixed-ability and mixed-gender groups, task learners to apply knowledge in reducing a topographical map to enlarge a part of the map by a given scale factor. Move round to provide support for learners in need.* iii. *Guide learners as they work in pairs, to use the appropriate tools such as rulers, pencils, and pens to mark the key features between two points of a topographical map for cross sectional drawing. Provide enough time for learners to work at appropriate pace and scaffold/support when necessary.* *Level 1: Construct a cross section with the elevations recorded.* *Level 2: Construct a cross section with elevations recorded and appropriate annotations provided.* *Level 3: Construct a cross section with*	

	elevations recorded, appropriate annotations provided and areas of inter-visibility indicated. *h) Core Points:* *i. Steps in reducing a topographical map:* ➢ *Measure the length and width of the map using a ruler.* ➢ *Divide the length and width by a scale factor. For instance, if the length of the map is 20cm and the width is 15cm and it is supposed to be reduced by a scale factor of ½, divide the dimensions each by 2 (new Length = 10cm, new Width=7.5cm).* ➢ *Use the dimensions to draw the outline of the map.* ➢ *Divide distances between features by 2 and then insert them on the map.* *ii. Steps in enlarging a topographical map:* ➢ *Measure the length and width of the map using a ruler.*	*elevations recorded, appropriate annotations provided and areas of inter-visibility indicated.* *h) Core Points:* *i. Steps in reducing a topographical map:* ➢ *Measure the length and width of the map using a ruler.* ➢ *Divide the length and width by the scale factor. For instance, if the length of the map is 20cm and the width is 15cm and it is supposed to be reduced by a scale factor of ½, divide the dimensions each by 2 (new Length = 10cm, new Width=7.5cm).* ➢ *Use the dimensions to draw the outline of the map.* ➢ *Divide distances between features by 2 and then insert them on the map.* *ii. Steps in enlarging a topographical map:* ➢ *Measure the length and width of the map using a ruler.*	

	➢ *Multiply the length and width by a scale factor. For instance, if the length of the map is 20cm and the width is 15cm and it is supposed to be enlarged by a scale factor of 2, multiply each of the dimensions by 2 (new Length =40cm , new Width=30cm).* ➢ *Use the dimensions to draw the outline of the map.* ➢ *Multiply distances between features by 2 and then insert them on the map.* *iii. Drawing a cross-section of a topographical map:* ➢ *Use a strip of paper and place it along the cross-section line. Make a mark and record the elevations.* ➢ *Take the strip of paper and put it on a fresh piece of paper (graph sheet).* ➢ *Make dots corresponding to the elevations along the strip of paper*	➢ *Multiply the length and width by a scale factor. For instance, if the length of the map is 20cm and the width is 15cm and it is supposed to be enlarged by a scale factor of 2, multiply each of the dimensions by 2 (new Length = 40cm, new Width=30cm).* ➢ *Use the dimensions to draw the outline of the map.* ➢ *Multiply distances between features by 2 and then insert them on the map.* *iii. Drawing a cross-section of topographical map:* ➢ *Use a strip of paper and place it along the cross-section line. Make a mark and record the elevations.* ➢ *Take the strip of paper and put it on a fresh piece of paper (graph sheet).* ➢ *Make dots corresponding to the elevations along the strip of paper*	

	representing the cross-section line. ➢ *Draw vertical lines representing the boundaries of the cross section.* ➢ *Join the points together with a line.* ➢ *Input appropriate annotations.* *i) Core Competencies:* *i. Digital literacy* *ii. Problem solving skills* *iii. Collaboration skills* *iv. Critical thinking skills* *j) Conclusion:* *Review lesson with learners by asking them in their various groups to summarise what they have learned in the lesson.* *k) Evaluation:* *Use the topographical map displayed to answer the questions that follow:*  *Source: WAEC, 2021* *i. Reduce the map by a scale factor of ½ (Level 1).*	*representing the cross-section line.* ➢ *Draw vertical lines representing the boundaries of the cross section.* ➢ *Join the points together with a line.* ➢ *Input appropriate annotations.* *i) Core Competencies:* *i. Digital literacy* *ii. Problem solving skills* *iii. Collaboration skills* *iv. Critical thinking skills* *j) Conclusion:* *Review lesson with learners by asking them in their various groups to summarise what they have learnt in the lesson.* *k) Evaluation:* *Use the topographical map displayed to answer the questions that follow:*  *Source: WAEC, 2021* *i. Reduce the map by a scale factor of ½ (Level 1).*	

	ii. On the new map, insert town Dambo (Level 2). *iii. Draw a cross section of the point A and B (Level 3).* *l) Remarks:*	*ii. On the new map, insert town Dambo (Level 2).* *iii. Draw a cross section of the point A and B (Level 3).* *l) Remarks:*	

PLC Session 11: Supporting numeracy across the curriculum through lesson observation			
Focus: the bullet points provide the frame for what is to be done in the session. The writer should use the bullets to guide what they write for the PLC Coordinators and teachers to do and say during each session. Each bullet needs to be addressed	**Guidance notes on Leading the session.** *What the PLC Coordinator will have to say during each stage of the session*	**Guidance Notes on Teacher Activity during the PLC Session.** *What teachers will do during each stage of the session*	**Time in session**
1. Introduction	1.1 Start the PLC session by asking teachers to share what they did differently in the classroom or elsewhere based on PLC Session 10, on *supporting the teaching and learning of numeracy at the right level in the social sciences,* which they think impacted learning positively *(*NTS 1a). 1.2 Ask teachers to discuss and summarise in a single sentence why they think what a colleague did by way of application of what they learned in Session 10, on *supporting the teaching and learning of numeracy at the right level in the social sciences,* supported learning (NTS 1a).	1.1 Share what you did differently in the classroom or elsewhere based on PLC Session 10, on *supporting the teaching and learning of numeracy at the right level in the social sciences*, which you think impacted learning positively (NTS 1a). 1.2 Discuss and summarise in a single sentence why you think what your colleague did by way of application of what they learned in Session 10, on *supporting the teaching and learning of numeracy at the right level in the social sciences,* supported learning (NTS 1a).	20 mins
2. Planning for teaching, learning and assessment	2.1 Ask a teacher to read the Purpose, Learning Outcomes (LOs) and	2.1 Read the Purpose, Learning Outcomes (LOs) and Learning Indicators (LIs) for the session.	30 mins

activities, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	Learning Indicators (LIs) for the session. **Purpose:** The session seeks to assist teachers to strengthen their ability to support the teaching and learning of numeracy across the curriculum through lesson observation. This approach will promote reflective practice among teachers to help improve the integration of numeracy in the various subjects. LO 1: Demonstrate knowledge and understanding of how to support numeracy across the curriculum through lesson observation (NTS 1a, 2b - 2f, 3a and 3e - 3k). LI 1.1 List the criteria in the observation guidelines for supporting the teaching and learning of numeracy across the TVET /SHS curriculum. LI 1.2 Analyse at least two ways in which the lesson observation guidelines can support the teaching and learning of numeracy across the TVET /SHS curriculum. LO 2: Demonstrate application of the use of the observation guidelines to support the teaching and learning of numeracy across the TVET /SHS curriculum (NTS 1a, 2b - 2f, 3a and 3e - 3k).	**Purpose:** The session seeks to assist teachers to strengthen their ability to support the teaching of numeracy across the curriculum through lesson observation. This approach will promote reflective practice among teachers to help improve the integration of numeracy in the various subjects. LO 1: Demonstrate knowledge and understanding of how to support numeracy across the curriculum through lesson observation (NTS 1a, 2b - 2f, 3a and 3e - 3k). LI 1.1 List the criteria in the observation guidelines for supporting the teaching and learning of numeracy across the TVET /SHS curriculum. LI 1.2 Analyse at least two ways in which the lesson observation guidelines can support the teaching and learning of numeracy across the TVET /SHS curriculum. LO 2: Demonstrate application of the use of the observation guidelines to support the teaching and learning of numeracy across the TVET /SHS curriculum (NTS 1a, 2b - 2f, 3a and 3e - 3k).	

	LI 2.1 Observe a lesson that incorporates numeracy across the TVET /SHS curriculum using the observation guidelines. LI 2.2 Provide feedback on how the lesson observed supports numeracy across the TVET/SHS curriculum. 2.2 Ask teachers in their subject domain groups to list the criteria in the observation guidelines for supporting the teaching and learning of numeracy across the TVET /SHS curriculum (NTS 1a, 2c and 2d). *Refer to Appendix 11 for the lesson observation guidelines* *E. g.* *a) Demographic information* *b) Pedagogical and assessment activities that incorporates numeracy concepts* *c) Cross cutting issues such as the incorporation of GESI, SEL, ICT and 21st Century skills that support numeracy skills* d) *Differentiated activities to support all learners develop numeracy skills, etc.* 2.3 Ask teachers in pairs to analyse at least two ways in which the lesson observation guidelines can support the teaching and	LI 2.1 Observe a lesson that incorporates numeracy across the TVET /SHS curriculum using the observation guidelines. LI 2.2 Provide feedback on how the lesson observed supports numeracy across the TVET/SHS curriculum. 2.2 In your subject domain groups, list the criteria in the observation guidelines for supporting the teaching and learning of numeracy across the TVET /SHS curriculum (NTS 1a, 2c and 2d). *Refer to Appendix 11 for the lesson observation guidelines* *E.g.* *Pedagogical and assessment activities that incorporative numeracy concepts, etc.* 2.3 In pairs, analyse at least two ways in which the lesson observation guidelines can support the teaching and learning of	

	learning of numeracy across the TVET /SHS curriculum (NTS 1a). *E.g.* *a) Applying the criteria in the observation guidelines to objectively assess lessons that focus on the incorporation of numeracy at the right level across the curriculum* *b) Providing constructive feedback that outline the strengths, challenges and possible areas of incorporating numeracy in lessons using positive language* *c) Accepting and reflecting positively on feedback to review lessons appropriately to incorporate numeracy at the right level, etc.* 2.4 Ask a teacher to teach a planned lesson in any subject area that incorporates numeracy across the TVET /SHS curriculum for a colleague to observe using the observation guidelines (NTS 1a, 1c, 1e, 2c and 3h). *Refer to Appendix 11 for the lesson observation guidelines*	numeracy across the TVET /SHS curriculum (NTS 1a). *E.g.* *Applying the criteria in the observation guidelines to objectively assess lessons that focus on the incorporation of numeracy at the right level across the curriculum, etc.* 2.4 Teach a planned lesson in your subject area that incorporates numeracy across the TVET /SHS curriculum for a colleague to observe using the observation guidelines (NTS 1a, 1c, 1e, 2c and 3h). *Refer to Appendix 11 for the lesson observation guidelines*	

	2.5 Ask the teacher who observed the lesson to provide feedback on how the lesson observed supported numeracy across the TVET /SHS curriculum (NTS 1a, 1c, 1e, 2c and 3h). 2.6 Ask teachers to discuss at least one alternative numeracy strategy that could be used in the lesson to develop numeracy concepts at the right level (NTS 1b, 2c - 2e, 3f and 3g). *E.g.* *a) Combining words and numbers to provide a complete understanding of concepts* *b) Using concepts in maths such as: Addition can be described as 'put together' or 'sum'* *c) Using visual images and shapes to reflect the meaning of mathematical concepts* *d) Using mathematical games to help learners develop mathematical concepts, etc.*	2.5 Listen and write the feedback on how the lesson observed supported numeracy across the TVET /SHS curriculum (NTS 1a, 1c, 1e, 2c and 3h). 2.6 Discuss at least one alternative numeracy strategy that could be used in the lesson to develop numeracy concepts at the right level (NTS 1b, 2c - 2e, 3f and 3g). *E.g.* *Combining words and numbers to provide a complete understanding of concepts, etc.*	
3. Modelling a teaching activity, making links with the Pre-Tertiary (standards-based) Curriculum and using GESI, SEL, ICT and 21st century skills	3.1 Ask teachers in groups to discuss how the activities observed in the model lesson promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3f). *E.g.* *a) Learners were actively engaged in mixed-ability/ mixed-*	3.1 In your groups, discuss how the activities observed in the model lesson promote GESI, SEL, ICT, 21st century skills and differentiation (NTS 3f). *E.g.* *Learners were actively engaged in mixed-ability/mixed-*	30 mins

	gender/mixed-culture groups which encouraged participation of all learners (males/females and SEN learners) *b) Learners were given the opportunity to share their ideas to the whole class using different presentation modes* *c) Learners were given differentiated activities according to their ability levels and learning needs which built their capacities, etc.* 3.2 Ask teachers to recommend other appropriate assessment strategies that could be used to support the development of numeracy skills in the observed model lesson (NTS 1a, 2e, 3f and 3m). *E.g.* *a) Group presentation* *b) Portfolio building* *c) Project work* *d) Exhibition* *e) Jury* *f) Game/puzzles* *g) Graph presentations, etc.* 3.3 Ask teachers to suggest alternative ways of using ICT in the observed lesson to support the teaching and learning of numeracy across the TVET/SHS curriculum (NTS 3j).	*gender/mixed-culture groups which encouraged participation of all learners (males/females and SEN learners), etc.* 3.2 Recommend other appropriate assessment strategies that could be used to support the development of numeracy skills in the observed model lesson (NTS 1a, 2e, 3f and 3m). *E.g.* *Portfolio building, etc.* 3.3 Suggest alternative ways of using ICT in the observed lesson to support the teaching and learning of numeracy across the TVET/SHS curriculum (NTS 3j).	

	E.g. *a) Showing of YouTube/Pre-recorded videos and podcast on mathematical related concepts in the subject area* *b) Using interactive whiteboard to present varied numeracy related concepts across the TVET/SHS curriculum* *c) Giving learners projects to search online and present information using charts and figures presented in PowerPoint, etc.*	*E.g.* *Showing of YouTube/Pre-recorded videos and podcast on mathematical related concepts in the subject area, etc.*	15 mins
4. Evaluation and review of session: ● **Noting that teachers need to identify critical friends to observe lessons and report at next session**	4.1 Ask teachers in pairs to discuss and share with the larger group what they have learnt about using lesson observation to support numeracy across the TVET/SHS curriculum (NTS 1a, 1b and 1f). 4.2 Remind teachers, where possible, to identify a critical friend to use the lesson observation guidelines in Appendix 11 to observe their lessons and provide feedback to them (NTS 1a, 1e and 3l). 4.3 Remind teachers to conduct peer lesson observations using the observation guidelines in Appendix 11 to support numeracy across the TVET/SHS Curriculum (NTS 1a, 3b).	4.1 In pairs, discuss and share with the larger group what you have learnt about using lesson observation to support numeracy across the TVET/SHS curriculum (NTS 1a, 1b and 1f). 4.2 Remember to identify a critical friend to use the lesson observation guidelines in Appendix 11 to observe your lessons and provide feedback to you (NTS 1a, 1e and 3l). 4.3 Remember to conduct peer lesson observations using the observation guidelines in Appendix 11 to support numeracy across the TVET/SHS Curriculum (NTS 1a, 3b).	10 mins

Appendix 11: Teacher Lesson Observation Sheet for Numeracy across the Curriculum

Region:

District:

Circuit:

School:

Name of Teacher:

Class:

Subject:

Topic:

Time:

	Question	Y*	N**	IP***	Comment
1.	Is/Are the purpose(s) of the lesson clearly stated in the lesson plan and focused on learners developing numeracy skills (i.e., **number, algebra, space & shapes and handling data**) and achieving the lesson learning outcomes irrespective of the subject taught?				
2.	Are learners engaged on tasks that provide opportunities for them to use their numeracy skills to complete the tasks?				
3.	Is teaching differentiated to cater for the varied numeracy needs of all learners across the ability range?				
4.	Does the teacher use real life examples which are familiar to learners and enable learners to apply numeracy skills?				
5.	Does the lesson include appropriate interactive and creative approaches e.g., group work, role play, storytelling to support learners in developing numeracy skills irrespective of the subject taught?				

6.	Does the teacher demonstrate knowledge and understanding of how numeracy can support the teaching of their subject?				
7.	Is Gender Equality and Social Inclusion responsive language used in the lesson to address numeracy-related challenges learners face?				
8.	Are cross-cutting issues integrated in the lesson to support numeracy development? e.g., problem-solving, logical thinking, use of ICT as a tool for highlighting numeracy -related activity?				
9.	Are teaching/learning materials and other resources being used to support learning support numeracy development?				
10.	Does the teacher maintain a non-threatening learning environment throughout the lesson by using numeracy examples accessible to the learners?				
11.	Does the teacher encourage learners to ask numeracy-related questions during the lesson?				
12.	Does assessment include assessment as, for and of learning?				

* Yes ** No ***In part

www.t-tel.org