PROFESSIONAL DEVELOPMENT PROGRAMME

Tutor Professional Development Handbook: B.Ed. in Initial Teacher Education - Mathematics Year 2 Semester 1

HANDBOOK FOR **COORDINATORS**

GHANA TERTIARY EDUCATION COMMISSION

NATIONAL TEACHING COUNCIL
NTC
Building Confidence, Raising Teaching Standards

The Government of Ghana

mastercard foundation

T-TEL
Transforming Teaching, Education & Learning

Foreword

I am grateful that you are reading and using this Professional Development Handbook for the Bachelor of Education (B.Ed.) in Initial Teacher Education Year 2 Semester 1 courses.

These Professional Development Handbooks are at the heart of Ghana's ambitious teacher education reforms and have played a key role in the successes achieved to date. The Handbooks aim to ensure that tutors in Colleges of Education are reflecting critically on their methods of teaching and learning and supporting each other to implement the B.Ed. in line with the National Teacher Education Curriculum Framework and National Teacher Education Assessment Policy.

Tutors act as role models for student teachers. If tutors use the 'lecture-method' then this is what student teachers will imitate when they enter basic school classrooms. If tutors use a wide variety of interactive approaches, aligned with the National Teachers' Standards, then these approaches will become standard behaviour for beginning teachers when they graduate.

This latest set of Professional Development Handbooks, developed by four mentoring universities (Kwame Nkrumah University of Science and Technology, University of Education, Winneba, University for Development Studies and University of Ghana) and tutors from their affiliated Colleges of Education, are the first set of Handbooks which include specific cross cutting sessions in Gender, Equality and Social Inclusion (GESI) and Information and Communications Technology (ICT).

The introduction of GESI in these Handbooks is an important step forward in ensuring that our teacher education system is responsive and genuinely promotes equality and inclusion whilst the inclusion of ICT represents Ghana's aim of ensuring that all teachers and learners are digitally literate.

As with previous Handbooks I would like to take this opportunity to thank both the Ghana Tertiary Education Commission and Mastercard Foundation for their assistance and support in making this work possible.

Robin Todd
Executive Director, T-TEL

TABLE OF CONTENTS

Year Two Semester One
Writing the weekly PD sessions: Guidance for the Subject Writing Leads (SWL).

- The PD sessions are an important way to ensure effective implementation of the key principles and practices of the B.Ed. *It is critical that what SWL write provides direct subject and B.Ed. specific guidance, so SL/HoD can support and scaffold tutors learning and professional development.*
- The sessions need to provide *the PD* opportunity for tutors fully understand what they need to teach and to planning together to make sure the new B.Ed. courses are taught well
- Developments since the manuals were written require SWL to add additional detail to sessions. Specifically, this means a focus on:
- Integrating GESI to ensure the needs of females, males and students with special education needs are well catered for
- Integrating ICT and 21c skills to ensure students learn to use technology effectively to support their own and pupils' learning
- National Teacher Education Assessment Policy (NTEAP)
    - the three assessment components *for the semester* for **EACH** course: subject project (30%), subject portfolio (30%) and end of semester examination (40%). These need to be introduced in session 1. PD writers will need to provide an example portfolio and project assessment components if these are not written into the course manuals (See Appendix 2: Course Assessment Components at a Glance).
    - integrating the use of continuous assessment designed to support student teacher learning in each session
- The PD session template provides the frame for SWL to write the guidance for the Subject Leads (SL)/HoD on how to lead and support the professional development of tutors in the weekly sessions for student teachers
- Age level specialisms are introduced in Y2S1. To ensure appropriate subject and age level focus for the PD sessions:
    - there will be subject specialists writing for each subject
    - where subjects are grouped direct reference needs to be made to examples of activities in the course manuals for each subject
    - where there are different age levels direct reference needs to be made to the course manuals for activities for each age level
- STS is six days in year 2 Semester 1 and involves observation and working with small groups subjects should include STS activities
- SL/HoD need to have details of the resources needed for the activities

GENDER, EQUALITY AND SOCIAL INCLUSION (GESI)

Tutor PD Session for Lesson 001 in the Course Manual

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1.0 Introduction to GESI	1.1 Task tutors to individually read the introduction (to GESI) and learning outcomes below and invite opinions from both male and female tutors and those with special needs where applicable. **Introduction to GESI:** **a. Purpose of GESI in the specialisms** Communities all over the world consist of diverse individuals and social groupings that have different needs, strengths, opportunities, and concerns as a result of differences in culture, gender, abilities, economic and social status. As teacher educators, it is important to understand	1.1 Read and discuss the introduction to (to GESI) and the learning outcomes below and provide your opinion on same. **Introduction to GESI:** **a. Purpose of GESI in the specialisms** Communities all over the world consist of diverse individuals and social groupings that have different needs, strengths, opportunities, and concerns as a result of differences in culture, gender, abilities, economic and social status. As teacher	**20 mins**

	the uniqueness of the diverse groups in the classroom and ensure that every individual is supported to attain quality education. Towards promoting equal opportunity for females and males as well as all other disadvantaged groups in the classroom, GESI in schools is being championed. Tutors need to have a clear understanding of GESI issues to be able to integrate these in the teaching and learning process and other aspects of college life and to encourage student teacher to do same during STS. **b. Overview of GESI and related concepts** This session seeks to expose tutors in all the specialisms (EG, UP and JHS) to the concept GESI and related issues such as Gender, Equality, Equity etc to enable them appreciate issues of stereotypes and work towards challenging traditional gender roles as well as dealing with their own unconscious biases so they can attend to the diverse needs of all learners in the classroom and in the College.	educator, it is important that you understand the uniqueness of the diverse groups in the classroom and ensure that every individual is supported to attain quality education. Towards promoting equal opportunity for females and males as well as all other disadvantaged groups in the classroom, GESI in schools is being championed. You need to have a clear understanding of GESI issues to be able to integrate these in the teaching and learning process and other aspects of college life and to encourage student teacher to do same during STS. **b. Overview of GESI and related concepts** This session seeks to expose you to the concept GESI and related issues such as Gender, Equality, Equity etc to enable you appreciate issues of stereotypes and work towards challenging traditional gender roles as well as dealing with your own unconscious biases so you can attend to the diverse needs of all learners in the classroom and in the College.	

	c. Session learning outcomes By the end of this session, tutors will be able to i. demonstrate understanding of the concept GESI and related issues. ii. apply these concepts in their teaching and general practices. iii. support student teachers to understand GESI issues and how to apply them during STS. 1.2 Task tutors to identify what the acronym GESI stands for and explain what it means. **G**ender, **E**quality and **S**ocial **I**nclusion is a concept that addresses unequal power relations experienced by people on the grounds of gender, wealth, ability, location, ethnicity, language and agency or a combination of these dimensions. 1.3 Using talk for learning strategies (concept cartoons, storytelling, role play discussion etc), ask tutors in their subject groups to explain any <u>two concepts</u> related to GESI. Allow tutors to use their phones/laptops to search for how each concept is related to education. <u>www.google.com</u>	**c. Session learning outcomes** By the end of this session, you will be able to i. demonstrate understanding of the concept GESI and related issues. ii. apply these concepts in your teaching and general practices. iii. support student teachers to understand GESI issues and how to apply them during STS. 1.2 Identify what the acronym GESI stands for and explain what it means. 1.3 In your subject groups, explain any <u>two concepts</u> related to GESI. (you may use your phones/laptops to search for how each concept is related to education from <u>www.google.com</u> Adapt differentiated approaches to explain concepts (sketches, role play, story etc).	

	Allow tutors to explain concepts using differentiated approaches (sketches, role play, story etc). Employ a creative approach, such as quizzes to capture attention. **Gender** is the relationship between men and women and the roles and responsibilities they have in the society. Example in Ghana it is socially accepted that cooking is the role of women and providing upkeeping money for the family is the role of men. **Equality** is the similarity of treatment as it is legally and constitutionally given. Example is providing **all** children (irrespective of ability, gender, socio-economic background etc.) with opportunities to achieve quality learning outcomes. **Equity** is the state of being fair or just in terms of provision of resources, support or opportunities base on individual learners need; the result is equality in achievement. **Inclusion** is the process of valuing all individuals and leveraging their diverse talent, not in spite of their differences, but because of their differences. Example Ensuring that **all** students (boys, girls and SEN) are given equal opportunities		

	to participate in the classroom.) **Gender Equality** is a state where males and females have equal rights, life prospects and opportunities to shape their own lives and contribute to society. **Social Inclusion** is the process of improving the terms of participation for people who are disadvantaged, through enhancing opportunities and access to resources. 1.2 Ask tutors to reflect on their understanding of GESI and justify the need for GESI in education. For instance, the classroom and school environment have been skewed in ways that condone gender bias and promote exclusion. **Example 1:** Male characters are often represented than females in TLMs and textbooks. **Eg. 2** Persons with SEN are often disadvantaged during some classroom activities: the blind learner loses out when pictures are used. The Deaf lose out when only verbal language is used. **Refer to Appendix 1.**	1.2 Reflect on your understanding of GESI and justify its importance in education.	
2. Identification and discussion of new learning	2.1 Through questioning, ask tutors to identify and discuss how each new GESI concept they have acquired could be	2.1 identify and discuss how the new GESI concepts you have acquired could be useful in your teaching and general school life.	**15 mins**

	useful in their teaching and general school life. *Eg. a) Inclusion: mix ability/gender grouping; involving all categories of learners in every activity.* *Eg. b) Equity: provide support and resources in line with the needs of each learner.* **N/B:** Encourage tutors to support student teachers identify how each concept could be used during STS. 2.2 Using think-pair-share ask tutors to identify possible barriers to learning GESI for student teachers and how to address them.		
Potential barriers to learning for student teachers	Examples may include: ***Misconceptions:*** *those certain roles are for specific gender; boys are brave and can dissect a rabbit and girls are good cooks than boys. This can be addressed by citing instances where girls demonstrate bravery and boys have been better cooks.* ***Negative attitudes****: the perception that persons with SEN are low achievers. Address this by giving examples of persons with SEN who have excelled in various aspects of life (Hellen Keller, Professor Danaah)*	2.2 Reflect individually, share with a colleague and then the entire group possible barriers to learning GESI for student teachers and how to address them. Examples may include: ***Misconceptions:*** *those certain roles are for specific gender; boys are brave and can dissect a rabbit and girls are good cooks than boys. This can be addressed by citing instances where girls demonstrate bravery and boys have been better cooks.* ***Negative attitudes****: the perception that persons with SEN are low achievers. Address this by giving examples of persons with SEN who have excelled in various aspects of life (Hellen Keller, Professor Danaah)*	

	(Tutors may share their experience of unfair treatment/unconscious biases that constitute barriers to GESI).	(Tutors may share their experience of unfair treatment/unconscious biases that constitute barriers to GESI).	
3.0 Planning for teaching, learning and assessment activities for the lesson/s	3.1 Using talk for learning (small group discussion, plenary discussion) guide tutors to identify and discuss GESI responsive practices that support in creating GESI friendly school and classroom environments. (reference to college context) *Eg. a) Involving men and women equally in decision making* *b) ensuring that all college facilities are accessible by everyone (abled bodied and persons with disability),* *c) Equitable allocation of resources among all college actors (males, females, minority groups) etc* 3.2 Ask tutors to brainstorm aspects of the basic school curriculum that need improvement in the area of GESI. *E.g. a) Play activities: girls and boys could play soccer and ampe.* *Eg. b) decision making school prefects are mostly boys: girls and students with special education needs could equally be appointed school prefects.*	3.1 Identify and discuss GESI responsive practices that support in creating GESI friendly school and classroom environments. (Reference to college context). *Eg. a) Involving men and women equally in decision making* 3.2 Brainstorm aspects of the basic school curriculum that need improvement in the area of GESI. *E.g. a) Play activities: girls and boys could play soccer and ampe.*	**30 mins**

Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills GESI responsive assessment Resources: links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability	3.3 Task tutors to discuss in their subject groups and come out with strategies on how GESI, ICT, and 21st Century skills can be integrated in their specific subject areas. 3.4 Lead tutors to identify and possible strategies to make subjects projects and subject portfolios GESI responsive. *Eg. a) Equitable distribution of relevant resources for the subject projects* *Eg. b) Ensure projects content do not portray GESI biases and stereotypes. In grouping students for subject projects ensure mix ability/gender groupings* **Note** Remind tutors to consciously ensure GESI responsiveness in conducting continuous assessment in their various disciplines. Eg a) ensure that leadership roles are assigned equally among females, males and students with special education needs (SEN) when assessments (subject projects) are done in groups. Eg. b) Ensure equitable distribution of resources among males, female and (SEN).	3.3 Identify strategies on how GESI, ICT, and 21st Century skills can be integrated in their specific subject areas. 3.4 identify and discuss possible strategies to make subjects projects and subject portfolios GESI responsive. *Eg. a) Equitable distribution of relevant resources for the subject projects* **Note:** Make conscious efforts to ensure GESI responsiveness in conducting continuous assessment for student teachers (eg subject project)	

	3.5 Task tutors in their subject groups, to identify and discuss the links to existing GESI resources such as the Gender Handbook for CoEs	3.5 identify and discuss the links to existing GESI resources such as the Gender Handbook for CoEs Read GESI resources for new ideas to improve your lesson preparation and classroom practice.	
4. Evaluation and review of session: • Tutors need to identify critical friends to observe lessons and report at next session. • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	4.1 Invite critical friend (male/female) to observe a lesson using the observation checklist and give feedback on next PD session. *Example: equal involvement of both males, females and SEN learners.* 4.2 Write the concepts learned on pieces of paper and call tutors at random to pick one and explain to the whole group. Give further clarification where applicable. **Advance Preparation for lessons** 4.3 Encourage tutors to read GESI related resources for new ideas to improve their lesson preparation and classroom practices.	4.2 Invite critical friend (male/female) to observe a lesson using the observation checklist and give feedback on next PD session. *Example: equal involvement of both males, females and SEN learners* 4.2 Pick and explain GESI concepts learnt giving examples in classroom and out of class situations. **Advance Preparation for lessons** 4.3 Read GESI related resources for new ideas to improve their lesson preparation and classroom practices.	**15 mins**

GESI Appendix 1 – UNDERSTANDING GENDER - TERMS AND CONCEPTS

Sex is aspect of one's biological makeup that depends on whether one is born with distinct male or female genitals and a genetic programme that releases either male or female hormones to stimulate the development of one's reproductive system. Sex is biologically defined. It is determined by birth. It is universal and unchanging.

Gender is simply the relationship between men and women and the roles and responsibilities they have in the society in which they live. It refers to the socially constructed differentiated roles assigned to both sexes, whereby both men and women are expected to conform to and perpetuate the roles and behaviors that have been assigned to them. Gender is socially constructed and differs between and within cultures. It is about the differences in roles, responsibilities, opportunities, needs and constraints of men and women.

Some Distinctive Features of Gender:

- Deals with the relationship between men and women
- Deals with the roles and responsibilities men and women are assigned by their society
- Both men and women are expected to conform to and perpetuate the roles and behaviors that have been assigned them
- It involves the ranking of traits and activities so that those associated with men are normally given greater value
- It is historical
- It is learned, and therefore can be unlearned
- It takes place within different macro and micro spheres such as the state, the labour market,
- schools, the media, the law, the family, household and interpersonal relations
- It interacts with race/ethnicity, age, disability, status, economic factors, etc. Meaning these factors may present different gender dynamics and expectations.

Gender Roles define what is considered appropriate for men and women within a given society. It also means socially assigned roles of men and women and informs the division of labour. It involves the relation to power (how it is used, by whom and how it is shared). It varies greatly from one culture to another and change over time. Gender roles may vary from one social group to another within the same culture.

Gender Relation refers to how men and women relate to each other, resulting in manifestations of gender based power. This arises from the roles men and women are expected to play and the impact of their interactions. The family is a good example, as men assume the earner and leader roles, women assume the domestic and care giving roles. These power relations are uneven because the male has more power in making decisions than females. If we do not conform to roles prescribed to us by society, we are seen to be deviant by society. Power relations always result in one party being worse off than the other

and create social imbalances. This means inequality between men and women that is acquired in the process of socialisation.

Gender Responsiveness refers to outcomes that reflect an understanding of gender roles and inequalities and which make an effort to encourage equal participation and equal and fair distribution of benefits.
Gender responsiveness is accomplished through gender analysis and gender inclusiveness. It means creating an environment that reflects an understanding of the realities of women and men's lives and address the issues accordingly. Being gender responsive means having the capacity to analyse a specific context from a gender perspective, to develop gender sensitive course outline, lesson notes, teaching learning materials and to allocate budgets in a gender-responsive way.

Gender Stereotyping refers to the practice of ascribing to an individual woman or man specific attributes, characteristics, or roles by reason only of her or his membership in the social group of women or men.

Gender Stereotype simply means the constant portrayal, such as in the media, conversation, jokes or books, of women and men occupying social roles according to a traditional gender role or division of labour. Gender stereotyping is wrongful when it results in a violation or violations of human rights and fundamental freedoms.

Equality refers to the equal rights, responsibilities and opportunities of men, women and persons with special education needs and disabilities. It pertains to equal distribution of resources and benefits and participation of women and men in all areas of society. It also means giving equal weight to the knowledge, experience and values of both women and men in society. Equality between men and women is a human rights issue and a pre-condition for sustainable development. It is based on the principle that, though men and women are not the same biologically, they are equal as human beings.

Equity is based on principle of fair share. It is a stage in the process of achieving equality. Equity refers to a fair sharing of resources, opportunities and benefits according to a given framework. It is one of the measures of equality, but not the only one. Equity is measurable and manifested in parity. Experience illustrates that equity is used instead of equality within institutions.

Equality vs Equity. Equality refers to similarity of treatment as it is legally, constitutionally and divinely given. It is a fundamental right. And it is often the goal. Equity is often viewed as a favour, whereas equality is a fundamental right.

Empowerment is a process through which women, men and persons with disability in disadvantaged positions increase their access to knowledge, resources, and decision-making power, and raise their awareness of participation in their communities, in order to reach a level of control over their own environment.

Gender Mainstreaming is the concept of bringing gender issues into the mainstream of society. It was established as a global strategy for promoting gender equality in the Platform

for Action adopted at the United Nations Fourth World Conference on Women held in Beijing in 1995. The conference highlighted the necessity to ensure that gender equality is a primary goal in all areas of societal development. In July 1997, the United Nations Economic and Social Council (ECOSOC) defined the concept of gender mainstreaming as follows: "Mainstreaming a gender perspective is the process of assessing the implications for women and men and persons with special education needs and disability of any planned action, including legislation, policies or programmes, in any area and at all levels. It is a strategy for making the concerns and experiences of women as well as of men an integral part of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres, so that women and men benefit equally, and inequality is not perpetuated. The ultimate goal of mainstreaming is to achieve gender equality".

Mainstreaming in education involves placing learners with special education needs and disability in a general education classroom with a special education teacher as a co-teacher giving them the same opportunities as other learners to access instruction, gain knowledge, and to participate in the academic and socializing environments that a school offer.

Inclusion is the process of valuing all individuals and leveraging their diverse talent, not despite their differences, but because of their differences. Inclusion requires a conscious effort to involve all human resources in the fabric and mission of the institution or school as a critical value addition.

Disempowerment is any action, policy development and/or relief program or process through which women's, men's and persons with disabilities priorities, needs and interests are further ignored, reducing their participation in decision- making and representing an obstacle to their economic, political and social improvement, or to their academic progress and growth attainment.

Patriarchy is an ideology and social system that propagates male supremacy or male power and superiority over women as natural. The operating premise is that men are biologically, intellectually and emotionally superior to women. Conversely, women are considered to be weak and dependent on men for protection, guidance, upkeep and general survival. The ideology is institutionalised through active formal and informal systems, backed up by ideas, beliefs, religion, practices and culture – and sometimes by force. A patriarchal ideology is the key factor in the structural gender inequality in most of our societies.

Gender Neutrality is the claim some people make when they want to present themselves as not practising gender-based discrimination. What it often masks, however, is the failure to take gender issues into consideration, and this can translate into discrimination against girls as it fails to pay attention to the distinct and special needs of girls and boys.

Gender blindness is the failure to recognise the differences between males and females and therefore leading to failure to provide for the differences.

Other concepts/ terminologies:
Marginalisation - exclusion in processes such as decision-making. This results in women's inability to articulate their needs and interests.

Discrimination - differential treatment based on factors over which an individual has no control, e.g. sex, disability, socio-economic status, tribe, nationality, race, etc.

Objectification - assignment of less than human status and treatment to women.
Infantilisation - categorising women with children, i.e. having no legal decision making powers, voting rights or capacity to enter into contracts.

Dispossession - through patriarchal systems of property inheritance, where is some cultures women are not allowed to inherit wealth.
Segregation occurs when students with disabilities are educated in separate environments (classes or schools) designed for students with impairments or with a particular impairment.

Exclusion occurs when an individual or group is denied the right to access (facilities, education) or participate in educational or social activity on the bases of ability, gender, health or social status.

Value Assignment - determining a woman's value by the sex and number of children she bears.

Violence - physical, mental and emotional abuse, which is culturally accepted as correcting a wife or harmful practices such as female genital mutilation to subdue female sexual urge

Poor refers to households or persons who consume an average of less than 2,220 calories of food per person per day. (according to Nepal Living Standard Survey, 2010/11)

Vulnerable Groups refer to groups that experience a higher risk of poverty and social exclusion than the general population. Ethnic minorities, migrants, person with disabilities, the homeless, those struggling with substance abuse, isolated elderly people and children all often face difficulties that can lead to further social exclusion, such as low levels of education and unemployment or underemployment.

Gender Impact Analysis/Assessment examines policies and practices to ensure they have beneficial effects on women and men. It identifies the existence and extent of differences between women and men and the implications of these differences for specific policy areas.

Social Exclusion describes the experience of groups that are systematically and historically disadvantaged because of discrimination based on gender, ethnicity or religion.

Gender Responsive Budget refers to government planning, programming and budgeting that contributes to the advancement of gender equality and the fulfillment of women's rights. It entails identifying and reflecting interventions to address gender gaps in sector and local government policies, plans and budgets.

Disaggregated Data refers to distinguishing men and women, ethnic minorities, people with disability, people with HIV and other excluded people in the data to reveal quantitative differences between them.

Why the need for GESI in education?

The need to deliberately address gender and inclusion in the classroom arises because, over time, the classroom and school environment have been skewed in ways that condone gender bias and promote exclusion. Below are examples of practices in the classroom that reinforce traditional gender roles and stereotypes:

a. Male characters are often represented than females in TLMs
b. Textbooks have more males than females in illustrations
c. Illustrations in TLMs often portray gender stereotypes (male CEO and decision makers, females in domestic roles etc.)
d. Persons with disability are underrepresented
e. When persons with disability are featured, they are portrayed with negative stereotypes
f. (Cursed, beggars or burden on society)
g. Use of male pronouns to represent everyone (ignoring the existence of females)
h. Persons with disability are identified by their disability. Often their disability is put before them – for example, deaf man, "handicapped" child, blind girl etc

Some misconceptions of GESI in Schools and out of Schools and how to address them

a. GESI seeks to favour women
b. GESI affects the learning outcomes of the “normal” learner
c. Society thinks education is for men
d. Concerns only persons with disabilities
e. Quality inclusion is expensive
f. Only schools are responsible for the implementation of GESI
g. Persons with disability cannot cope in mainstream school.
h. Disability is contagious

Ways the misconceptions can be addressed

These can be addressed through:

- Behavior change communication approaches
- Continued sensitization and advocacy of GESI
- Mainstreaming GESI responsiveness in school and community practices and activities

Barriers that hinder GESI and how to address them in and out of schools

a. Infrastructural barriers such as inaccessible school facilities
b. Curriculum barriers such as deficient resources and learning materials for learners
c. attitudinal barriers such as insensitivity and discrimination by teachers, parents, peers and the society at large
d. Pedagogical barriers such as teachers not having necessary knowledge and skills on GESI responsive pedagogy.
e. Public misconception of what GESI seeks to achieve
f. Large class size especially in the basic schools

g. Unavailability of relevant teaching and learning resources
h. Lack of expert support for the regular class teacher

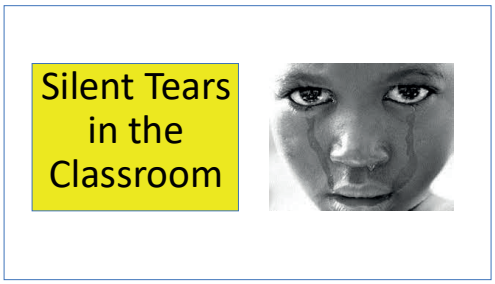
Ways the barriers can be addressed

These can be addressed through:

- GESI responsive infrastructure
- GESI responsive teacher education curriculum (include basic braille and sign language)
- Continuous advocacy
- Training teachers on GESI responsive pedagogies
- Train and deploy more special education teachers to the regular schools
- Provide relevant TLR for use in schools

Appendix 2 – GESI Observation Tool

A. Silent Tears



- Tears always fill me, but I can't pour them because no one understands me
- My parents can't even understand me because my teachers make them believe I am good for nothing
- I thought my parents will tell them that I repair all the electrical appliances in the house without any training
- Who will hear me now because myself and many who are like me are being destroyed?
- Who will help tell them that even though we might not be able to get the certificate we have great talents?
- Who will help tell teachers that they should not force their dreams on us but guide us nurture our God given talents?
- Who will hear our cry? I am one of the voices of the many silent voices in the class
- I wish I can be bold to tell my teachers that I must be understood and not compared
- My maths teachers say I'm good for nothing because I'm not good in calculations
- My science teachers say am useless because I can't express myself fluently in the white man's language
- They seem to have forgotten that I'm the one who led the school soccer team to win that trophy
- I am the same person who plays the drums to the admiration of all
- Sometimes when I ask why they consider what I do as important, they tell me WAEC doesn't ask those in examinations
- My teachers always say I don't do well even though they teach me well but how can I tell them that the teaching method doesn't favour me even though it favours the majority
- How can I tell my teacher that I just need motivation not condemnation?

B. Integrating GESI in Teaching and Learning

Introduction: The need to deliberately address gender and inclusion in the classroom arises because, overtime, the classroom and school environment have been made to overlook gender biases and continue to promote exclusion. GESI responsive pedagogy involve teaching and learning processes that pay attention to the specific learning needs of girls, boys and members of marginalised groups.

Overview of GESI Responsive Pedagogy:

Classroom practices often reinforce traditional gender roles, gender and inclusion stereotypes that may disadvantage some learners resulting in poor quality learning outcomes. There is therefore the need to challenge these practices to ensure equal learning

outcomes of all learners. This require teachers to be GESI responsive in lesson planning, selection and use of teaching and learning materials, methodologies, learning activities, classroom setup and interaction, management of gender stereotypes in the classroom and feedback and assessment.

Components of a GESI Responsive Lesson

1. **GESI Responsive Lesson Planning**

- Lesson planning involves a wide range of decisions:
- Content
- Choice of learning materials to use
- Methodologies
- Learning activities
- Language use
- Classroom setup
- Classroom interaction
- Assessment of the learning/ learner
- Fair knowledge of the background of learners to inform all the above
- For a lesson plan to take into account gender and inclusion considerations, the lesson planning process should involve the following:

2. **Choice of Learning Materials**

- Review the TLMs and identify if the material contains stereotypes?
- If so, what strategies can be used to address such stereotypes?
- If faced with a history textbook that portrays only heroes, it will be vital to draw up a list of "sheroes" (female heroes).
- If a chemistry textbook portrays only male scientists as inventors or abled bodied scientists, include discussing female scientists and scientists with disability.
- Carefully review the language used in the TLMs for gender responsiveness and inclusion.

3. **Teaching Methodologies**

- Select teaching methodologies that will ensure equal participation of girls, boys and students with special needs.
- Ensure that dominant individuals do not sideline less assertive ones. − Employ differentiated teaching approaches suitable for all learners.
- Protect students with disability from abuse or bully by other students.

4. **Learning Activities**

The lesson plan should make allowance for all students to participate in the learning activity.

- When doing science experiments, ensure that girls, boys and students with disability have a chance to use the equipment and chemicals.
- There should also be equal participation in such activities as making presentations.
- When assigning projects, ensure that both females and males are given leadership positions and roles.
- Take into account how the learning materials will be distributed equally to both girls and boys, especially in case of shortage or limited supply.

5. **Classroom Setup and Interaction**

The lesson plan should consider the classroom setup.

- Consider how to arrange the classroom and interact with the students to promote equal participation of all students.
- Plan in advance to ask substantive questions to all students.
- Where do you stand or sit during the lesson? Ensure that your position or posture does not exclude or intimidate students.

Management of other gender and inclusive constraints to learning inside the classroom

- In the planning process, make provision for time to deal with gender-specific problems, if any, such as girls who have missed class due to menstruation, household chores or family responsibilities. Or support to students with learning disabilities.
- Watch for indications of bullying, sexual harassment, adolescent hormonal upheavals, the impact of HIV/ AIDS, Pregnancy, Peer pressure, among others.

Feedback and Assessment

Make time for adequate feedback from girls, boys and students with special needs to ensure that lesson is well understood. Ensure that assessment methods do not disadvantage any marginalised group or individual in the class.

GESI Responsive Teaching & Learning Resources (TLRs)

TLRs are fundamental to the pedagogical process and are critical for shaping young minds. However, TLRs and textbooks often communicate traditional and limited gender roles. They also reinforce stereotypes about disabilities. Usually, the message in some materials is that women and girls are weak and passive and that persons with disabilities are a burden or are cursed. Consequently, male and female students continue to follow the status quo and reinforce negative stereotypes about women. In effect, men are challenged to take up leadership roles, whereas women continue to occupy the backbench. To ensure equality and inclusion, TLRs and other learning resources must empower both female and male students and students with disabilities.

Choose materials that depict persons of minority groups in a positive light. For example, a child with a physical disability playing with other children; an albino student in class with other children, a female statistician etc

GESI Responsive TLRs:

GESI Responsive Language Use in the Classroom

Language is a tool of communication. Inappropriate language use can transmit negative messages and inhibit learning. A boy or girl whose teacher constantly tells them "you are stupid" may believe this to be true. A teacher's constant use of harsh, abusive and threatening language may instil fear in the students. Language can also reinforce gender differences and inequalities

- Gender biases are expressed through language that reveals the belief that girls cannot perform as well as boys or that boys should not allow themselves to be outperformed by girls academically – or in any other way.
- Teachers sometimes discourage girls from taking science-based subjects or courses by telling them that such subjects are for boys or are too difficult for girls.
- When a girl is assertive, she is told to stop behaving like a boy, and when a boy cries, he is cautioned to stop acting like a girl.

- Spoken language is only part of the equation. Much offensive communication is not verbal. − An indifferent shrug of the shoulders or rolling of the eyes suggests that the student is too foolish or bothersome to warrant attention.
- Other gestures and body language, such as winking, touching, brushing, grabbing, and other moves, may be overtly sexual.
- It is also difficult for the victim to take steps to stop the abuse because there is often no tangible evidence. Most sexual harassment occurs and escalates in this way.

GESI Responsive Classroom Setup

How the classroom is arranged can contribute positively or negatively to teaching and learning processes. This includes the layout of the furniture in the classroom or laboratory, the quality of chairs and desks, and the overall physical infrastructure of the school. The height of shelves in the classroom can contribute to an interactive classroom setup or exclude student of a certain height.

To ensure GESI responsiveness in the way a classroom is set up, the following needs to be considered:

- A classroom setup that mixes girls and boys and also considers disabilities − Classroom setup that enhances the participation of all students
- Arrangement of the desks that allow students with disabilities to be comfortable − Appropriate shelf heights in the libraries and laboratories.
- Stools in laboratories that are appropriate in size and shape thus enabling effective participation of both girls and boys.
- Fixtures and visual aids on the walls that send gender-responsive messages
- Appropriate size, shape and weight of desks and chairs.

GESI Responsive Classroom Interaction: Students are boys and girls with gender-specific needs. Especially as they mature, their gender roles can have an increasing impact on classroom interactions. An existing disability introduces different classroom dynamics. Sexual experimentation, sexual harassment, male domination, female passivity, and bullying come into play in the classroom. The following are essential steps towards building good classroom rapport:

Look for characteristics such as shyness, arrogance, distraction and low confidence.

- Take into account that some students are slow learners, some are gifted, and most are better in some areas than others.
- It is important to go beyond academic ability. Bear in mind that some learners come from disadvantaged situations.
- Orphans, displaced, the very poor or may have hidden disabilities
- Watch out for the gender-specific needs of students: girls who are having problems because they are going through their menstrual cycle.

Appendix 3 – GESI Observation Tool

Name of Tutor		**Sex**				
Course Title		**Level**				
Subject/Topic						
Gender and Inclusion Responsive competency	**Some Strategies and Actions to observe:**		Not achieved	Partially achieved	Half achieved	Fully achieved
			0	1	2	3
1. The Tutor uses Gender and Inclusion responsive pedagogy in class (aim for a score of 19-21)	**The Tutor:** 1) gives equal chance to females and males to ask and answer questions in class (and provides extra encouragement to girls who may lack confidence)					
	2) uses participatory methods such as group work, debates and role play; and ensures equal participation of females & males (giving extra encouragement where needed)					
	3) pays attention to the composition of females and males during group work and assigns females leadership roles					
	4) ensures that females have equal access to teaching and learning resources (TLMs, books, desks, etc.), particularly if males are more assertive and take resources first					
	5) is patient with females and males who may be shy or afraid to speak					
	6) checks to see if both females and males understand the lesson					
	7) provides constructive/positive verbal feedback to both females and males in class					
Total score						
2. The Tutor uses Gender and Inclusion responsive language and interaction	**The Tutor:** 1) does not use negative expressions or language that demeans, excludes, or gives females the impression that are not as intelligent or do not need to perform as well as males					
	2) does not use harsh/threatening language or actions that instil fear in both females and males					

(aim for a score of 19-21)	3) does not say things that reinforce false assumptions about females and males (e.g., girls are bad at maths/science, girls are always shy, boys are the first to answer)				
	4) does not use body language that excludes girls or shows preferential treatment to boys (such as speaking mostly to boys or turning your back to girls)				
	5) sets ground rules that prohibit teasing or bullying, particularly from males towards females				
	6) builds students' (especially females') skills for self-confidence, speaking out and leadership				
	7) knows the difference between 'being friendly' with girls and being flirtatious. Jokes and conversations <u>should not</u> have sexual undertones, and Tutors should not use terms like 'girlfriend' or 'sweetie'.				
Total score					
3. The Tutor uses Gender and Inclusion responsive TLMs (aim for a score of 10-12)	**The Tutor:** 1) reviews all textbooks, pictures, posters, and materials before using them to see if they reinforce traditional Gender and Inclusion roles (e.g., women cooking/cleaning, men in professional roles)				
	2) identifies traditional Gender and Inclusion roles that appear in books/materials and makes a point to alert students to these portrayals when using the materials in class				
	3) discusses with students how portrayals of traditional Gender and Inclusion roles limit what female students think they can do and achieve				
	4) ensures that books, materials, or equipment are equally distributed amongst females/males				
Total score					
4. The Tutor challenges	**The Tutor:** 1) empowers males to be critical of and challenge traditional views of masculinity				

traditional Gender and Inclusion roles (aim for a score of 10-12)	(e.g. men should be 'powerful', should not be 'weak', should never cook/clean)				
	2) empowers females to be critical of and challenge traditional views of femininity (e.g., women should be dependent on men, should only be mothers/carers, should not be assertive)				
	3) actively uses examples (e.g., exercises, activities, role play, pictures) that *challenge or reverse* traditional Gender and Inclusion roles (such as having men cook)				
	4) supports and encourages females to achieve in maths and science and aspire to professions traditionally taken by men (such as engineering, police, medicine)				
Total score					
5. The Tutor uses Gender and Inclusion responsive planning (aim for a score of 15-18)	**The Tutor:** 1) plans classroom seating so that males and females are mixed, and so that pupils who need more support sit at the front				
	2) reviews student attendance every 2-3 months (particularly for females) - if there are problems with attendance, the Tutor should follow up with the head Tutor and parents				
	3) reviews student assessments every 2-3 months - if there are large gaps between females and males, the Tutor should develop strategies to close the gaps				
	4) plans to use teaching strategies that ensure equal participation of both females and males				
	5) reviews TLMs for traditional Gender and Inclusion roles and ensures that materials are distributed and used equally between female and males				
	6) plans to use exercises/activities that do not reinforce traditional Gender and Inclusion roles and in some cases, actively *challenges* or *reverses* traditional Gender and Inclusion roles				
Total score					
Overall score					

Class size	
Number of Females	
Number of Males	

Name of Peer Tutor (Observer)

…….

Signature

……

Thank you for completing this observation tool.

ICT AS CROSS-CUTTING TOOL FOR TEACHING AND LEARNING

Purpose

This manual is prepared to

1. help tutors plan and teach learner-centred lessons using ICT
2. provide tutors access to and use of ICT tools for assessment *of, for* and *as* learning
3. introduce tutors to the use ICT for the development of 21st century skills
4. guide tutor in their use of ICT software and hardware for teaching and learning.

Preamble

Teachers in the 21st century are facing new challenges because of the expanding possibilities of ICT integration in every aspect of the school curriculum. Research works have shown the potential of Tutor Professional Development (TPD) that is tailored to local conditions as well as global components and takes advantage of mutual support among tutors, as well as modelling of effective practices.

Welliver's Instructional Transformation Model sets goals and expectations for all teachers at whatever stage they are starting at. The five hierarchical stages start with familiarization, then utilization, integration, reorientation, and finally revolution.

1. **Familiarization:** is when teachers become aware of technology and its potential uses.
2. **Utilization:** teachers use technology, but minor problems will cause them to discontinue its use.
3. **Integration:** technology becomes essential for the educational process and teachers are constantly thinking of new ways to use technology in their classrooms
4. **Reorientation:** teachers begin to rethink the educational goals of the classroom with the use of technology.
5. **Revolution:** is the evolving classroom that becomes completely integrated with technology in all subject areas. Technology becomes an invisible tool that is seamlessly woven into the teaching and learning process.

ICTs have the capabilities to bring several benefits to teachers and students such as shared learning resources, shared learning spaces and promotion of cooperative and collaborative learning they also provide a base for autonomous learning. ICTs have enabled us to communicate one to one, one to many and many to many through communication channels and networking. They provide a means to organize institutions differently and lead to new ways of working together with virtualization. With implementation and integration of ICTs in teacher education, the society has been transformed into a knowledge society. During the International Conference on ICT and Post-2015 Education, the 2015 Qingdao Declaration stated the importance of the professional development of teachers to effectively integrate ICT into their work.

Successful integration of ICT into teaching and learning requires rethinking the role of teachers and reforming their preparation and professional development. It calls for promoting a culture of quality in all its aspects: staff support, student support, curricula design, course design, course delivery, strategic planning, and development. We will therefore ensure that teacher-training institutions are equipped and prepared to use ICT adequately to expand the benefits of

training and professional development programmes to all teachers, and to act as the vanguard for technology-supported innovations in education. We also commit to providing teachers with system-wide support for the pedagogical use of ICT, to incentivize teacher innovation, and to develop networks and platforms that allow teachers to share experiences and approaches that may be of use to peers and other stakeholders. (UNESCO, 2015)

Mishra and Koehler (2006) expressed the fact that technology has changed the way we teach (pedagogy), what we teach (content), and the context in which teaching/learning happens. Thus, to say that technology gives us new opportunities to connect with the content and use new pedagogical strategies to pass the content to our students.

In the field of teacher education ICT-based applications and their integration with content, method and pedagogy are potential catalysts for meaningful learning of students. Professionals associated with teacher education institutions should equip them to design their educational system and prepare teachers for the future of the society (Singh, 2014).

With implementation of ICTs and its effective integration with teaching and learning process, the approaches to learning and teaching has changed to reflect global competencies of the 21st century teacher. The basic approaches are as follows:

- Learner Centric: Explore the best in every student.
- Learning Centric: Learner learn by designing and preparing meaningful learning experience with the help of a teacher.
- Promoting Inquisitiveness: Develop questioning ability in learner. Teacher encourages learner to ask questions. It leads to critical thinking.
- Innovation Centric: Teacher promotes innovation, creativity, and team spirit in learner.
- Develop cooperative and collaborative learning environment: Learning occurs through discussion, interaction and debate called learning for development.

Teacher is expected to perform the role of a facilitator and moderator with different responsibilities in different situations in a technology-mediated learning environment, called networked society. There is the need for specialized training and orientation of teachers to enable the teacher to develop the classroom, school and society with new skills and competencies. For this reason, the expectation of the National Teacher Curriculum Framework (NTECF) is that student teachers should be equipped a set of competencies and skills so that they can in turn inculcate in their learners the competencies and skills. The set of skills and competencies provided by the NTECF, subsequently captured by the Pre-Tertiary Education Curriculum Framework are:

- critical thinking and problem-solving skills,
- creative and innovative skills,
- life-long learning/personal Life skills,
- collaborative/social skills,
- communication skills,
- literacy and numeracy skills,
- leadership skills,
- entrepreneurial skills,
- digital literacy/information, communication & technology (ICT) skills and,
- civic literacy.

ICT can be used to leverage the development of these skills and competencies if teachers are intentional about the ICTs use for skills and competencies development.

Learning Outcomes	Indicators
1. Demonstrate knowledge and understanding of the basic ICT tools and their impact on 21st century skills	1.1 Mention and describe some basic ICT tools and how to use them, including: Computers, and other hardware, software. 1.2 21st century skills and ICT tools that can be used to integrate them in lessons. 1.3 Analyse and evaluate the changes brought about by the introduction of ICT.
2. Demonstrate use of basic ICT tools for planning lessons	2.1 Perform basic lesson planning tasks using an ICT tool, e.g., using Google calendar. 2.2 Create, edit, format, save and print documents using various productivity tools. 2.3 Use the internet to search for information
3. Demonstrate use of basic ICT tools for teaching, learning and assessment	3.1 Perform basic teaching tasks using an ICT tool, e.g., using PowerPoint, Google classroom, zoom, Google meet. 3.2 Perform basic lesson assessment tasks using an ICT tool, e.g., using Google forms. 3.3 Use the internet to search for activities for teaching, learning and assessment
4.Demonstrate use of basic ICT tools for research	4.1 Perform basic research tasks using an ICT tool, e.g., using survey monkey, Google forms. 4.2 Use the internet for literature search including theoretical and conceptual frameworks

ICT TOOLS

ICT tools – both software and hardware – can be used for planning, teaching, learning, assessment, data management and for research, with some of them able to perform multiple functions. Some of these tools are stated below with a brief note on their usage.

ICT TOOLS FOR PLANNING LESSONS

AnswerGarden is a tool for online brainstorming and collaboration.

BrainPOP Lets you use pre-recorded videos on countless topics to shape your lesson plan, then use quizzes to see what stuck.

Buncee Helps students and teachers visualize, communicate, and engage with classroom concepts.

Class Dojo: This is a fun tool to gamify the classroom. Students make their own avatars, gain and lose points based on classroom behavior, discussion approaches, and other soft skills agreed upon by the teacher and the class. Teachers can also use Class Dojo to take attendance and create graphs that breakdown the information for teachers. Not only will this tool encourage students to uphold class values, but it will also provide key metrics to help teachers adjust their teaching tactics accordingly.

Coggle A mind-mapping tool designed to help you understand student thinking.

Conceptboard is a software that facilitates team collaboration in a visual format, similar to mind mapping but using visual and text inputs.

Dotstorming A whiteboard app that allows digital sticky notes to be posted and voted on. This tool is best for generating class discussion and brainstorming on different topics and questions.

Flipgrid: Flipgrid is the video discussion tool from Microsoft that opens-up the classroom. It is designed to allow students to speak to the group but without the same fear that might constrict responses in a real-world situation. Students can re-record responses, removing the pressure of answering in class, on the spot. Of course, it's also a great tool for use when learning remotely.

Google Calendar: With Google Calendar, you can quickly schedule meetings and events and get reminders about upcoming activities, so you always know what's next. Calendar is designed for teams, so it's easy to share your schedule with others — students and colleagues for example — and create multiple calendars that you and your team can use together.

Google Classroom: Google Classroom is a free web service, developed by Google for schools, that aims to simplify creating, distributing, and grading assignments in a paperless way. The primary purpose of Google Classroom is to streamline the process of sharing files between teachers and students. Google Classroom combines *Google Drive* for assignment creation, storage and distribution, Google Docs (equivalent of Microsoft Word), Sheets (equivalent of Microsoft Excel) and Slides (equivalent of Microsoft PowerPoint) for writing/word processing, calculation and graphing, and presentation respectively Gmail for communication, and Google Calendar for scheduling.

Google Meet: Google Meet is a google enterprise-grade video conferencing app. Now, anyone with a Google Account can create an online meeting with up to 100 participants and meet for up to 60 minutes per meeting.

PowerPoint Presentation: PowerPoint is a presentation programme developed by Microsoft. PowerPoint is often used to create business presentations but can also be used for educational or informal purposes. The presentations are comprised of slides, which may contain text, images, and other media, such as audio clips and movies. A good PowerPoint presentation enables teachers to make their lessons engaging, interactive and real.

Voov Meeting: VooV Meeting allows attendees to join meetings quickly on mobile phones, PCs, tablets, and webpages for a seamless conferencing experience across platforms

Zoom: Zoom Cloud Meetings is a proprietary video teleconferencing software program developed by Zoom Video Communications. It enables you to virtually interact with your students when in-person meetings are not possible, and it has been hugely successful for teaching and learning.

(**Zoom, VooV Meeting and Google Meet are good for collaborative lesson planning with colleagues).**

ICT TOOLS/APPS FOR TEACHING

AudioNote A combination of a voice recorder and notepad, it captures both audio and notes for student collaboration.

Edmodo is a free learning management platform that merges classroom content, safe communication, and assessment with social media savvy. Students and parents can get quick answers to questions as well as stay current on class assignments and happenings via the student planner and discussion threads. It provides a simple way for teachers to create and manage an online classroom community as well as enables students to connect and work with their classmates and teachers anywhere and anytime. The Ghana Library Authority as subscribed to this platform and available for teachers, students, and their parents to use. **Edpuzzle** helps you use video (your own, or one from Khan Academy, YouTube, and more) to track student understanding.

GeoGebra for Teaching and Learning Math. It is a free digital tool for class activities, graphing, geometry, collaborative whiteboard and more

Google Classroom: Google Classroom is a free web service, developed by Google for schools, that aims to simplify creating, distributing, and grading assignments in a paperless way. The primary purpose of Google Classroom is to streamline the process of sharing files between teachers and students. Google Classroom combines Google Drive for assignment creation and distribution, Google Docs, Sheets and Slides for writing, Gmail for communication, and Google Calendar for scheduling.

Jamboard is a digital interactive whiteboard in a collaborative whiteboard space with options to draw, add pictures, shapes, sticky notes, and text boxes. Jamboard is one smart display. Quickly pull in images from a Google search, save work to the cloud automatically, use the easy-to-read handwriting and shape recognition tool, and draw with a stylus but erase with your finger – just like a whiteboard.

Kasahorow is a vocabulary-enriching platform that helps to learn the English language and modernize African languages like a child. Kasahorow Keyboards for Android lets you type in Akan, English, Gbe, Ga-Dangme, Hausa and Yoruba conveniently. It is used as a normal keyboard by simply installing and selecting when you want to type an African language on any Android devices you have.

Kahoot is an online game-based learning platform. It allows teachers, organizations, and parents to set up fun web-based learning for others. Kahoot can be used as a fun trivia activity to do with students or teachers to have a series of fun questions at the same time learn.

Math Kids is a free learning game designed to teach young children numbers and mathematics. It features several mini games that toddlers and pre-K kids will love to play, and

the more they do the better their math skills will become. Adding Quiz will put your child's math and addition skills to the test.
Other mathematics applications are, inMaths, Geomaths

Moodle: Moodle stands for Modular Object-Oriented Dynamic Learning Environment. Moodle was designed to provide educators, administrators, and learners with an open, robust, secure, and free platform to create and deliver personalised learning environments. Moodle is a user-friendly Learning Management System (LMS) that supports learning and training needs for a wide range of institutions and organisations across the globe.
Photomath is a mobile application that utilizes a smartphone's camera to scan and recognize mathematical equations; the app then displays step-by-step explanations onscreen. It is available for free on both Android and iOS. It uses the camera on a user's smartphone or tablet to scan and recognize a math problem. Once the problem is recognized, the app will display solving steps, sometimes in a variety of methods or multiple approaches, to explain the scanned problem step-by-step and teach users the correct process.
Piazza Lets you upload lectures, assignments, and homework; pose and respond to student questions; and poll students about class content. This tool is better suited for older students as it mimics post-secondary class instructional formats.
QuickVoice Recorder Allows you to record classes, discussions, or audio for projects. Sync your recordings to your computer easily for use in presentations.
StudyGe: This is a geography for children. This learning game will help you to remember location of countries, their capitals and flags. You can train your memory and memorize information about countries. This offline platform will allow students to improve your knowledge of geography. Other geography platforms are LearnGeography, AP Human Geography
Telegram is a mobile application that allows users to communicate with them using mobile gadget and computer. Telegram can be used for teaching and learning for the following reasons:
Multiple platforms: smartphones (Operating system, Android), PC, Laptop, iPad, Tab, and Web., Compatible file format, large files transfer, Grouping facilities, better storage capacity and management, better memory system and management, better security with the encryption. Telegram can be used for teaching and learning in the following ways: announcement, forum i.e., whole class discussion, Quizzes, open ended question, group project report, listening practice, pronunciation practice, speaking practice, writing practice, problem solving, Content/materials sharing, PowerPoint presentation.
Vocaroo Is a quick and easy way to record and share voice massages over the interwebs. Vocaroo creates audio recordings without the need for additional software. The recordings are easy to be embedded into PowerPoint presentations and websites.
Whiteboard is an instant formative assessment tool for your classroom, providing you with live feedback and immediate overview over your students. Engage your whole class, include every student and let everybody answer - including the shy students or students who normally wouldn't bother to answer.

DIGITAL ASSESSMENT TOOLS FOR TEACHERS

Classmarker: Classmarker is an online testing software that offers a free version that is very complete providing teachers with interesting possibilities for formative and summative evaluations. A professional web-based Quiz maker is an easy-to-use, customizable online testing solution for business, training & educational assessments with Tests & Quizzes graded instantly, saving hours of paperwork

Edulastic Allows you to make standards-aligned assessments and get instant feedback.

Gimkit Lets you write real-time quizzes.

Google Forms: Google Forms is a tool that allows collecting information from users through a personalized survey or exam. Google Forms is a free tool from Google that allows you to do the following: Create forms, surveys, quizzes, and such. Share the forms with others. Allow others to complete the forms online.

Kahoot - game-based assessment tool.

Mentimeter - pre-built education templates.

Naiku Lets you write quizzes students can answer using their mobile devices.

Poll Everywhere - used by 300,000 teachers.

Quiz Bot - Create a quiz with several multiple-choice questions and test on telegram

Socrative - quizzes and questions with real-time grading.

World Geography – Quiz Games for Geography

World Map Quiz – quizzes and questions for Geography

ICT TOOLS/APPS FOR RESEARCH

Academia.edu: is a platform for academics to share research papers. The company's mission is to accelerate the world's research.

ai.google: Google periodically releases data of interest to researchers in a wide range of computer science disciplines.

Biohunter: A Portal with literature search, data statistics, reading, sorting, storing, field expert identification and journal finder.

Code Ocean is a Cloud-based computational platform which provides a way to share, discover and run published code.

DataBank: Is an analysis and visualization tool that contains collections of time series data on a variety of topics.

Datacatalogs.org offers open government data from US, EU, Canada, CKAN, and more.

Data.gov: The USA government's official data portal offers access to tens of thousands of data sets

Data.gov.in: An Open Government Data (OGD) Platform India - is a platform for supporting Open Data initiative of Government of India. The portal is intended to be used by Government of India Ministries/ Departments their organizations to publish datasets, documents, services, tools and applications collected by them for public use. It intends to increase transparency in the functioning of Government and also open avenues for many more innovative uses of Government Data to give different perspective.

Data.gov.uk: The British government's official data portal offers access to tens of thousands of data sets on topics such as crime, education, transportation, and health

DeepDyve: provides simple and affordable access to millions of articles across thousands of peer-reviewed journals. Content from the world's leading publishers including Reed Elsevier, Springer, Wiley-Blackwell, and more.

GitHub: An Online software project hosting using the Git revision control system.
Open Science Framework: This gathers a network of research documents, a version control system, and a collaboration software.

Google Finance: it provides stock market data and give updates in real time.

Google Scholar is a freely accessible web search engine that indexes the full text or metadata of scholarly literature across an array of publishing formats and disciplines.

Microsoft Academic Search: Find information about academic papers, authors, conferences, journals, and organizations from multiple sources.

Peer Evaluation: is an Open repository for data, papers, media coupled with an open review and discussion platform.

QuillBot is a paraphrasing and summarizing tool that helps millions of students and professionals cut their writing time by more than half using state-of-the-art AI to rewrite any sentence, paragraph, or article.

ResearchGate is the professional network for scientists and researchers. Over 15 million members from all over the world use it to share, discover, and discuss research.

Sciencescape: An Innovation in the exploration of papers and authors.

SlideShare: Community for sharing presentations and other professional content

SSRN: Is Multi-disciplinary online repository of scholarly research and related materials in social sciences.

Turnitin is an originality checking and plagiarism prevention service that checks your writing for citation mistakes or inappropriate copying. When you submit your paper, Turnitin compares it to text in its massive database of student work, websites, books, articles, etc.

Tutor PD Session on ICT Integration & 21st Century Skills

Age Levels/s: EG,UP,JHS Name of Subject/s: ICT Integration

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
Introduction to the session	1.1 Self-introduction: Ask tutors to introduce themselves. 1.2 Ask tutors to share any successes and issues they had when using ICT tools in a previous semester *employing talk for learning strategies.* 1.3 Asks tutors who are conversant with and have utilized ICT tool(s) in Lessons in the previous semester(s) to share their practices and how these ICT tools and its integration has impacted on their teaching in any of the semester(s). It is important to identify the topic as well as the ICT tool(s) used in the discussion.	1.1 Kindly introduce yourself to the group. 1.2 Tutors share any successes and issues they had when using ICT tools in a previous semester *employing talk for learning strategies.* 1.3 Tutors who are conversant with and have utilized ICT tool(s) in Lessons in the previous semester(s) to share their practices and how these ICT tools and its integration has impacted on their teaching in any of the semester(s). It is important to identify the topic as well as the ICT tool(s) used in the discussion.	**20 mins**

	1.4. Ask tutors to read the purpose, the learning outcomes and learning indicators of the manual and use the think-pair-share approach to share their views about how the manual can help them to integrate ICT into their lessons. **Distinctive aspects** Lead tutors to discuss ICT tool(s) they are familiar with and any unique qualities of these ICT tool(s) as learning tools that they can identify. Note: The following are the distinctive aspects that this manual has considered: Reading literacy, writing literacy, numeracy, information literacy, ICT [information and communications technologies] digital literacy, communication and can be described broadly as learning domains. 1.5 Ask tutors to pair with a colleague and share their views about the ICT tools that they have used in their everyday life and how the unique qualities of these tool(s) can be incorporated into their classroom teaching.	1.4. Read the purpose, the learning outcomes and learning indicators of the manual and use the think-pair-share approach to share your views about how the manual can help you to integrate ICT into their lessons. **Distinctive aspects** Tutors to discuss ICT tool(s) they are familiar with and any unique qualities of these ICT tool(s) as learning tools that they can identify. Note: The following are the distinctive aspects that this manual has considered: Reading literacy, writing literacy, numeracy, information literacy, ICT [information and communications technologies] digital literacy, communication and can be described broadly as learning domains. 1.5 Pair with a colleague and share your views about the ICT tools that you have used in your everyday life and how the unique qualities of these tool(s) can be incorporated into your classroom teaching.	

	1.6 In groups ask tutors to write on a flip chart using Concept Cartoons: a. ICT tool (s) tutors are familiar with. e.g., email, mobile phones, computers, slides, animation, zoom, telegram, etc. b. ICT tool(s) tutors use and integrate in their teaching at the College of Education 1.7 Let tutors present their findings via *radio reporting.*	1.6 In groups, write on a flip chart using Concept Cartoons: a. The distinctive features of ICT tool(s) you are familiar with b. CT tools you use and integrate in your teaching at the College of Education. 1.7 Present your findings via *radio reporting.*	
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	**Concept Development** 2.1. Using the think, pair, share approach, assign tutors sub-topics of integrating ICT into teaching and learning (*equity, health and safety issues relating to the use of ICT tools*) to tutors to discuss and write points on a flip chart for presentation. Allow time for each presentation and whole group discussion. 2.2 Ask tutors to work in pairs and examine the misconceptions in teaching and learning with ICT tool(s) and share ideas on how to address them. E.g. computers can do everything a teacher can do	**Concept Development** 2.1. Discuss the sub-topic, assigned to you with your partner and share your views with the larger group 2.2 In pairs, discuss misconceptions in teaching and learning with ICT tool (s) and share possible ways of addressing them. E.g. computers can do everything a teacher can do	**25 mins**

	2.3 Ask tutors to outline possible challenging areas in teaching with ICT tool(s) taking into consideration GESI (e. g. identifying areas in the curriculum where stereotypes are reinforced and addressing these).	2.3 Outline possible challenging areas in teaching with ICT tool(s) taking into consideration GESI (e. g. identifying areas in the curriculum where stereotypes are reinforced and addressing these).	
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous	**Teaching and learning activities:** 3.1. Discuss with tutors, general ICT tools for teaching and learning Desktop and laptops computers, Projector, Digital cameras, Printer, Photocopier, tablets, Popplet, Pen Drive, Ipods, Ipads, Webboards, Scanners, Microphones, interactive white board, DVDs and CDs Flash discs, video Games **E.g.,** **Geomaths** **Maths kits** **Microsoft maths solver** **Photomaths** **Scratch** **kasahorow** • **Software** • **Office Professional** – E.g. XP. • **Good photo software** e.g. Microsoft Digital Photo Suite • **"Photostory 2** -- comes with service pack 2.	**Teaching and learning activities:** 3.1 Discuss general ICT tools for teaching and learning Desktop and laptops computers, Projector, Digital cameras, Printer, Photocopier, tablets, Popplet, Pen Drive, Ipods, Ipads, Webboards, Scanners, Microphones, interactive white board, DVDs and CDs Flash discs, video Games **E.g.,** **Geomaths** **Maths kits** **Microsoft maths solver** **Photomaths** **Scratch** **kasahorow** • **Software** • **Office Professional** – E.g. XP. • **Good photo software** e.g. Microsoft Digital Photo Suite • **"Photostory 2** -- comes with service pack 2.	**40 mins**

assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, YouTube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	• **Inspiration** • **Smart Notebook** ○ **United Streaming** subscription • **Hardware** • **Flat Screen monitor** Good quality printer preferably a laser black and color photo. E.g. HP • **CD/DVD RW drive(s)** • **USB ports** • **Scanner** – e.g. Epson brand • **Digital camera – e.g.** of Canon • **External storage** - an external hard drive to back up data • **Portable storage** - USB flash drive, 2 GB minimum. • Palm or other **handheld device** to keep schedules, dates, reminders, and store pictures and music. E.g. Tungsten Palm • **Smart board** or **Smart Airliner**, with projection unit for classroom use. • **CPS** (classroom performance system) also for classroom use. **Teaching 21st Century Skills with ICT** **Collaborative Problem Solving**	• **Inspiration** • **Smart Notebook** ○ **United Streaming** subscription - • **Hardware** • **Flat Screen monitor** Good quality printer preferably a laser black and color photo. E.g. HP • **CD/DVD RW drive(s)** • **USB ports** • **Scanner** – e.g. Epson brand • **Digital camera – e.g.** of Canon • **External storage** - an external hard drive to back up data • **Portable storage** - USB flash drive, 2 GB minimum. • Palm or other **handheld device** to keep schedules, dates, reminders, and store pictures and music. E.g. Tungsten Palm • **Smart board** or **Smart Airliner**, with projection unit for classroom use. • **CPS** (classroom performance system) also for classroom use. **Teaching 21st Century Skills with ICT** **Collaborative Problem Solving**	

	https://youtu.be/cnkKHL_dyGE **Creativity** https://www.youtube.com/watch?v=qV7DiTFdtvw **Hands-On Learning** https://youtu.be/vYUNfJ9lKzs **Effective Written and Oral Communication** https://www.youtube.com/watch?v=D5hMN_XkPQA **Ethical Decision Making** https://youtu.be/Iwk8dGFn1tY **Information and Media Literacy** https://youtu.be/bjYhmTC3lrc **Critical Thinking** https://youtu.be/y7iMEH7jGFk https://youtu.be/88DoGrqEuJk **Leadership** https://youtu.be/-NF10F6bX_g **Personal Responsibility and Initiative** https://youtu.be/nRE131ErclM 3.2 Lead tutors to discuss Special Education Needs (SEN) ICT tools for teaching, learning and assessment. **E.g.,** Teachers dealing with the SEN will require special ICT tools like; text magnifier, head wands,	https://youtu.be/cnkKHL_dyGE **Creativity** https://www.youtube.com/watch?v=qV7DiTFdtvw **Hands-On Learning** https://youtu.be/vYUNfJ9lKzs **Effective Written and Oral Communication** https://www.youtube.com/watch?v=D5hMN_XkPQA **Ethical Decision Making** https://youtu.be/Iwk8dGFn1tY **Information and Media Literacy** https://youtu.be/bjYhmTC3lrc **Critical Thinking** https://youtu.be/y7iMEH7jGFk https://youtu.be/88DoGrqEuJk **Leadership** https://youtu.be/-NF10F6bX_g **Personal Responsibility and Initiative** https://youtu.be/nRE131ErclM 3.2 Discuss Special Education Needs (SEN) ICT tools for teaching, learning and assessment. **E.g.,** Teachers dealing with the SEN will require special ICT tools like; text magnifier, head wands,	

	keyboard for cerebral Palsy, braille, typing aids, large prints, audio books. 3.3 Lead tutors to discuss some useful Education Technology Resources for teaching, learning and assessment. **E.g.,** Office 365 vs G-Suite for Education Google Meet for Online Teaching Google Classroom for Online Assignment submissions Plagiarism checking Softwares Tools for Checking Grammar errors Online Assessment tools include: grading rubrics, Canvas Assignments, plagiarism detection, self-assessment, and peer assessment, surveys, and classroom polling. Quiz bot Digital Assessment Tools for Teachers: Socrative - quizzes and questions with real-time grading. Classmarker- quizzes and questions with real-time grading Google Forms - easy to use. Mentimeter - pre-built education templates. Poll Everywhere - used by 300,000 teachers. Kahoot - game-based assessment tool. • Further links to videos for further application of ICT tools in the teaching and learning process	keyboard for cerebral Palsy, braille, typing aids, large prints, audio books. 3.3 Discuss some useful Education Technology Resources for teaching, learning and assessment. **E.g.** Office 365 vs G-Suite for Education Google Meet for Online Teaching Google Classroom for Online Assignment submissions Plagiarism checking Softwares. Tools for Checking Grammar errors Online Assessment tools include: grading rubrics, Canvas Assignments, plagiarism detection, self-assessment, and peer assessment, surveys, and classroom polling. Quiz bot Digital Assessment Tools for Teachers: Socrative - quizzes and questions with real-time grading. Classmarker- quizzes and questions with real-time grading Google Forms - easy to use. Mentimeter - pre-built education templates. Poll Everywhere - used by 300,000 teachers. Kahoot - game-based assessment tool. • Further links to videos for further application of ICT tools in the teaching and learning process	

	https://www.youtube.com/watch?v=k8nMh71ky4Y 3.4 Ask tutors to suggest ICT-mediated teaching, learning and assessment activities in their respective subjects taking into account GESI. E.g., Making reasonable adjustments using ICT for physically challenged learners. E.g. Both male and female learners playing leading roles in ICT-based group tasks. 3.5 Let tutors present their findings to the larger group	https://www.youtube.com/watch?v=k8nMh71ky4Y 3.4 Suggest ICT-mediated teaching, learning and assessment activities in your respective subjects. aking into account GESI. E.g., Making reasonable adjustments for physically challenged learners. Both male and female learners playing leading roles in a group task. 3.5 Present your findings to the larger group	
• **Evaluation and review of session:** • Tutors need to identify critical friends to observe lessons and report at next session • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	4.1 Ask tutors to identifying any outstanding issues relating to the lesson/s for clarification 4.2 Ask tutors to identify a critical friend who will observe their first lesson and give them feedback on how they integrated ICT in the lesson.	4.1 Identifying any outstanding issues relating to the lesson/s for clarification. 4.2 Identify a critical friend who will observe your first lesson and give you feedback on how you integrated ICT in the lesson.	**5 mins**

MATHEMATICS

MATHEMATICS

Age Levels/s:

a. Early Grade
b. Upper Grade
c. JHS (Core)
d. JHS (Elective)

Name of Subject/s:

a. Theories in the Learning of Numeracy in Early Grade
b. Theories in Learning upper primary mathematics
c. Theories in Learning of Jnr High School Math.
d. Further Algebra

Tutor PD Session for Lesson 1 in the Course Manual

Lesson Tittle:

a. Early Grade - Why do we teach mathematics in school?
b. Upper Grade - Why do we teach mathematics in school?
c. JHS (CORE) - Why do we teach mathematics in school?
d. JHS (Elective) - Binary Operation: Learning, teaching and applying

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1a Introduction to the semester – in session one • Introduction to the purpose of the specialisms: EG, UP and JHS • Overview of subject/s age level/s to be covered in the PD	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity by asking tutors to mention any everyday life situation that is related to mathematics 1.2 Lead tutors to discuss the overview of the phases to be covered in	**Introduction** 1.1 Ice breaker: Mention any one everyday activity/situation and its related mathematical concept. 1.2 Discuss the overview of the phases to be covered in this PD	**20 mins**

sessions and guidance on grouping tutors according to the subject/s, age levels/s. • Introduction to the course manual/s • Overview of course learning outcomes • Introduction to the two continuous assessment components to be undertaken in each subject during the semester (See Course Assessment Components at a Glance Appendix 2) NB: in subjects where there are no assessment components in the course manuals examples will need to be provided for SL/HoD.	this PD session and how it will be organized. **Early Grade:** Theories in the Learning of Numeracy in Early Grade **Upper Prim-**Theories in Learning upper primary mathematics **JHS (Core)-**Theories in Learning of Jnr High School Math. **JHS (Elective) -** Further Algebra ***NB:*** *Remember to put members into groups according to the phases to be taught in the semester.* 1.3 Guide tutors to scan through the course manual and indicate the purpose of the specialisms: EG, UP and JHS i. **Early, Upper Prim & JHS (Core) Grade:** The course considers how an understanding of mathematics develops and the unique characteristics of learners in our basic schools. It also looks at how student teachers will develop awareness of equity and diversity ii. **JHS (Elective):** The course considers how: a) student teachers will develop mathematical models that can be used	**Early Grade:** Theories in the Learning of Numeracy in Early Grade **Upper Prim-**Theories in Learning upper primary mathematics **JHS (Core)-**Theories in Learning of Jnr High School Math. **JHS (Elective) -** Further Algebra ***NB:*** *Please work in your phase group and contribute in the whole group.* 1.3 Individually, scan through the course manual, identify the purpose of the specialisms (EG, UP and JHS) and share with the whole group.	

	to make a number of predictions including weather forecast, how much or less resources are needed to increase production in order to yield maximum or minimum profits and b) to explore the uses of algebraic concepts in real life situations (B.Ed JHS Revised Curriculum, PP. 944) ***NB:*** *Draw tutors' attention to all NTS references and salient points necessary for the development of their proforma.* 1.4 Ask tutors to read the introduction of the various course manuals (of the various phases named above) and discuss the course Learning Outcomes (CLOs) in groups as appropriate. 1.5 Ask tutors to discuss the two continuous assessment components to be undertaken during the course in line with the NTEAP *making reference to the appendix 2 of this PD Manual to be abreast with: i. The scope of the subject project and subject portfolio* *ii. The percentage/*	**NB:** *Pay attention to all NTS references and salient points necessary for the development of their proforma*. 1.4 Read the introduction of your course manual (of the appropriate phase) and discuss the course Learning Outcomes (CLOs) in groups as appropriate. 1.5 Discuss the two continuous assessment components to be undertaken during the course in line with the NTEAP *to be abreast with: i. The scope of the subject project and subject portfolio ii. The percentage/weight distributions and ii. Alternative tools for CA.*	

	weight distributions and iii. Alternative tools for CA.		
1b Introduction to the session • Review prior learning • Reading and discussion of the introductory sections of the lesson up to and including learning outcomes and indicators • Overview of content and identification of any distinctive aspects of the lesson/s, NB: The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson. NB: SL/HoD should ask tutors to plan for their teaching as they go through the PD session	1.6 Ask tutors to tell how useful the previous semester's PD session was and how it influenced their teaching in year 1 semester 2. Lead tutors to mention how students were well placed to employ the various strategies and skills during the Basic School classroom work including STS Field Experience. 1.7 Ask tutors to read and discuss the introductory section of lesson 1 in the course manual including the learning outcomes (LOs) in phase groups. 1.8 Ask tutors in phase groups to discuss the important or distinctive aspects of the first lesson including vocabulary and fundamental concepts. ***Distinctive aspects*** *include the interactive nature of the activities, emphasis on connecting concepts:* *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *– eg. How Mathematics relate to society and what it means to learn and teach Mathematics.* *b.* ***JHS; Further Algebra*** *– eg. Misconceptions, barriers,*	1.6 Tell how useful the previous semester's PD session was and how it influenced your teaching in year 1 semester 2. Mention how students were well placed to employ the various strategies and skills during the Basic School classroom work including STS Field Experience. 1.7 Read and discuss the introductory section of lesson 1 in the course manual including the learning outcomes (LOs) in phase groups. 1.8 In phase groups, discuss the important or distinctive aspects of the first lesson including vocabulary and fundamental concepts. ***Distinctive aspects*** *include the interactive nature of the activities, emphasis on connecting concepts:* *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *– eg. How Mathematics relate to society and what it means to learn and teach Mathematics.* *b.* ***JHS; Further Algebra*** *– eg. Misconceptions, barriers,*	

<table>
<tr>
<td></td>
<td>concepts and properties of binary operation
NB:
Be ready for possible questions from tutors for clarification.
Anticipated questions:
i. Which methods of teaching Mathematics at the EG/UP/JHS are good?
ii. Which methods of teaching Mathematics at the EG/UP/JHS are?
iii. How best does one introduce the concept of binary operation to JHS students?
Guide tutors to discuss the possible answers to the anticipated questions, bearing in mind pedagogy, GESI, ICT – E.g., the most appropriate methods depend on age and previous knowledge of learners, objective of lesson, etc.
Binary operation can be introduced through the operations learners are familiar with – eg. +, -, x. etc</td>
<td>concepts and properties of binary operation</td>
<td></td>
</tr>
<tr>
<td>2. Concept Development (New learning likely to arise in lesson/s):
• Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the</td>
<td>Concept Development
2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group.
<table><tr><th>Familiar Concepts</th><th>Unfamiliar concepts</th></tr><tr><td>Commutative property</td><td>Inverse property</td></tr><tr><td>Importance of mathematics</td><td>How Maths understanding develops</td></tr></table></td>
<td>Concept Development
2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group.</td>
<td>15 mins</td>
</tr>
</table>

lesson, which need to be explored with the SL/HoD NB: The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	2.2 Lead tutors to draw connections among concepts in the various lessons in line with the basic school curriculum. *Example: The connection between addition and subtraction is that one is the inverse of the other.* 2.3 Ask tutors to use Think-Pair-Share to outline possible challenging areas in teaching and assessing 'Why do we teach mathematics in school?' and 'Binary Operation.' *(Example: In Early, Upper Primary and JHS (Core) Grades, there is the challenge of presenting the lesson in a practical form without the relevant resources)* 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. *Example:* *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *– i) Mathematics is just about numbers and operations.* *ii) Some mathematics topics are not related to real life.* *b.* ***JHS (Further Algebra)*** *– Closure property is determined without considering the inverses of all the numbers in the number system used.*	2.2 In your phase groups, draw connections among concepts in the lesson and in line with the basic school curriculum. 2.3 Individually, outline the challenging areas in your lesson, share with a member of the same phase group and then with the whole group. 2.4 In whole group, discuss misconceptions and barriers in teaching and learning of the lesson. Example: a. ***Early, Upper Prim & JHS (Core) Grade:*** *(i) Mathematics is just about numbers and operations. (Ii) Some mathematics topics are not related to real life.* *b.* ***JHS (Further Algebra)*** *Closure property is determined without considering the inverses of all the numbers in the number system used.*	

	***Barriers** may include weak prior knowledge, lack of appropriate resources, lack of opportunity to use ICT due to failure of electric power (lights-out), bad/interrupted network, unavailability of internet bundle for students, inadequate contact time due to staff meetings.*	***Barriers** may include weak prior knowledge, lack of appropriate resources, lack of opportunity to use ICT due to failure of electric power (lights-out), interrupted network, unavailability of internet bundle for students, inadequate contact time due to staff meetings.*	
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous assessment to	**Planning for Teaching and learning Activities for the Lesson** 3.1 In their phase groups, ask tutors to suggest teaching and learning activities for the lesson ensuring; i. Provision is made for SEN ii. Both genders take leading roles in group task iii. Even distribution of questions to different categories of learners based on gender, ability, previous experience, etc. referring to NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Ask tutors to read the activities outlined in their course manuals and identify areas that require clarification. **NB:** *Refer to the Basic School Curriculum (BSC pp. xv – xvii) and http://uk.sagepub.com for explanations on "Why do we teach mathematics in school?" and search through "IXL Math" and GeoGebra to clarify the otherwise dark*	**Planning for Teaching and learning activities** 3.1 In your phase groups, ask tutors to suggest teaching and learning activities for teaching the lesson ensuring; i. Provision is made for SEN ii. Both genders take leading roles in group task, etc referring to NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Read the activities outlined in your course manuals and identify areas that require clarification. **NB:** *Refer to the Basic School Curriculum?" (BSC pp. xv – xvii) and https://uk.sagepub.com for information on "Why do we teach mathematics in schools? Use internet search such as "IXL Math",*	**40 mins**

support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, you tube physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	*spots in "Further Algebra".* 3.3 Lead tutors to brainstorm to come up with some pedagogical approaches and their impact on learning of the concepts taking into consideration inclusivity. *Example:* *i) The use of inquiry to explore how Mathematics relate to society.* *(ii) The use of differentiation and scaffolding to ensure that no learner is left behind (BSC pp. xv)* *iii) Being patient with stutterers, using tactile or braille for visually challenged, providing peer support for those who might need, while you pay attention to all Phases.* 3.4 Ask tutors to explain some suggested teaching strategies that can help inculcate core competencies in student teachers and for that matter Basic School learners. *Example: Using a)* ***Group Work*** *to discuss how Mathematics relate to society –* ***Social*** *and* ***Leadership Skills*** *b)* ***Investigation*** *to identify generalizations on properties to consider when investigating closure of*	*GeoGebra to clarify the otherwise dark spots in "Further Algebra".* 3.3 Brainstorm to come up with some pedagogical approaches that can be employed during the lesson and their effectiveness towards learning of the concepts. Mention any GESI issues that need consideration while using those approaches 3.4 Suggest teaching strategies to be used in achieving the LOs of the lesson and explain how they can help inculcate core competencies in student teachers and for that matter Basic School learners.	

	*number systems using Binary Operation – **Critical Thinking***		
	3.5 Ask tutors to mention some GESI responsive resources that can be used with the suggested approaches and strategies in achieving the LOs.	3.5 Mention some GESI responsive resources that can be used with the suggested approaches and strategies in achieving the LOs.	
	E.g. *Resources may include supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, projectors, flip charts, sticky notes, braille, tactile materials, audio and audio-visuals that can be used in the teaching and learning of the concepts mentioned above (NTS 3j)*	**E.g.** *Resources may include supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks.*	
	3.6 Using discussion, lead tutors to come out with assessment strategies ('as' and 'for') to be used during teaching of the lesson.	3.6 Using discussion, lead tutors to come out with assessment strategies ('as' and 'for') to be used during teaching of the lesson.	
	NB: Continuous assessment activities (assignments, quizzes, group presentations, etc. should be used to create subject projects and build subject portfolios). *Example: A project on how children learn using the Piagetian stages. (EG, UP)*	*NB: Continuous assessment activities (assignments, quizzes, group presentations, etc. should be used to create subject projects and build subject portfolios).* *Example: A project on how children learn using the Piagetian stages. (EG, UP)*	
	A project on investigation of closure of different number	*Make reference to assessment in the course*	

	systems under various binary operations (JHS) *Make reference to assessment in the course manual and NTEAP* 3.7 Ask each tutor to develop a sample of assessment item based on the LOs and share with the whole group. *Example: Early, Upper Primary and JHS (Core) Grades – Interview 10 basic school teachers during the STS activity on mathematics that basic school learners are exposed to a) at home & b) during play.* *JHS Grade – In groups of four, develop any game for teaching any concept within your course outline on Binary Operation.* 3.8 Lead tutors to discuss the various ways they can support student teachers to build their subject portfolio. *Example: Encouraging student teachers to file all their assignments with feedback in their folders.* *Taking notes in class and filing them.* 3.9 Ask a tutor to model a presentation of an activity using projector, internet search and taking into	*manual and NTEAP* 3.7 Develop a sample of assessment items based on the LOs and share with the whole group. *Example: Early, Upper Primary and JHS (Core) Grades – Interview 10 basic school teachers during the STS activity on mathematics that basic school learners are exposed to a) at home & b) during play* 3.8 Discuss the various ways you can support student teachers to build their subject portfolio. *Example: Encouraging student teachers to file all their assignments with feedback in their folders.* 3.9 Prepare and model a presentation of an activity using projector, internet search and taking into consideration	

	consideration GESI issues (eg. Both genders taking the leading roles in their groups) NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	GESI issues. (eg. Both genders taking the leading roles in their groups) NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	
4. Evaluation and review of session: • Tutors need to identify critical friends to observe lessons and report at next session • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Evaluation and review of session:** 4.1 Engage tutors in providing feedback of the PD session taking into consideration – Clarity of content, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi) and make notes that will help them to teach Lesson 1 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification. ***NB:*** *Take note of all unresolved issues that may need further research or consultation and use any of following strategies to address them.* *i. put on SL/SWL WhatsApp/ Telegram platform for discussion* *ii. tutors to research for the next PD session for discussion* 4.3 Ask tutors to identify a critical friend from the same or related discipline to observe the enactment of their	**Evaluation and review of session:** 4.1 Reflect and provide feedback on this PD session taking into consideration – Clarity of content, pedagogical approaches employed, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi)? and make notes that will help you to teach Lesson 1 4.2 Identify unresolved issues relating to this lesson for clarification. NB: *Put your unresolved issues unto* the department's *WhatsApp/ Telegram platform and research into the issues raised.* 4.3 Identify a critical friend from the same or related discipline to observe the enactment of your lesson and to	**15 mins**

	lesson and provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Ask tutors to remember to prepare proforma for Lesson 1 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 2 of the Course Manual on: <u>Early Grade</u> – Teacher beliefs about mathematics and their relation to teaching <u>Upper Primary</u> - Teacher beliefs about mathematics and their relation to teaching <u>JHS(Core)</u> - Teacher beliefs about mathematics and their relation to teaching <u>JHS (Elective.)</u> – Sequence and series; learning teaching and applying. NB: *i. Read the course manual the PD session guide, the NTEAP, and the NTS ahead of time to identify any outstanding issues relating to the lesson for clarification.* *ii. Collect all-inclusive resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLMs you may need and rehearse how these may be used to support the achievement of your goals*	provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Remember to prepare proforma for the lesson 1 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 2 of the Course Manual on: <u>Early Grade</u> – Teacher beliefs about mathematics and their relation to teaching <u>Upper Primary</u> - Teacher beliefs about mathematics and their relation to teaching <u>JHS (Core)</u> - Teacher beliefs about mathematics and their relation to teaching <u>JHS (Elective)</u> – Sequence and series; learning teaching and applying. NB: *i. Read the course manual the PD session guide, the NTEAP, and the NTS ahead of time to identify any outstanding issues relating to the lesson for clarification.*	

Age Levels/s:

a. Early Grade
b. Upper Grade
c. JHS (Core)
d. JHS (Elective)

Name of Subject/s:

a. Theories in the Learning of Numeracy in Early Grade
b. Theories in Learning upper primary mathematics
c. Theories in Learning of Jnr High School Math.
d. Further Algebra

Tutor PD Session for Lesson 2 in the Course Manual

Lesson Tittle:

a. Early Grade - Teacher beliefs about mathematics and their relation to teaching
b. Upper Grade - Teacher beliefs about mathematics and their relation to teaching
c. JHS - Teacher beliefs about mathematics and their relation to teaching
d. JHS - **Sequences** and Series: Teaching, Learning and applying

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1. Introduction to the session • Review prior learning • A critical friend to share findings for a short discussion and lessons learned • Reading and discussion of the introductory	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity for the lessons. *Example: What are best ways students learn Mathematics?* 1.2 Ask tutors to tell how useful the previous semester's PD session	**Introduction** 1.1 Mention some of the best ways students can learn mathematics best. 1.2 Tell how useful the previous semester's PD session was and how it	**20 mins**

sections of the lesson up to and including learning outcomes and indicators • Overview of content and identification of any distinctive aspects of the lesson/s, NB The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson. NB SL/HoD should ask tutors to plan for their teaching as they go through the PD session	was and how it influenced their teaching in year 1 semester 2. 1.3 Ask a critical friend to give feedback on observation during enactment of lesson first lesson. *NB: Things that a critical friend might have observed; tutor's choice of words, pedagogical content knowledge, content knowledge subject matter, ICT tools, GESI and the use of NTEAP* 1.4 Ask tutors to read and discuss the introductory section of the lesson including the learning outcomes (LOs) in phase groups. 1.5 Ask tutors to identify the purpose of the lesson from the course manual and state their expectations of the PD Session **Purpose of the Lesson** EG/UP/JHS (core): To develop student teachers' awareness of how teachers' beliefs about mathematics can influence their teaching.	influenced your teaching in year 1 semester 2 1.3 As a critical friend share his/her observation on the first lesson. 1.4 Read and discuss the introductory section of the lesson (up to learning outcomes). Suggest relevant previous knowledge of students that will support effective teaching and learning of the lesson. 1.5 Identify the purpose of the lesson from the course manual and state your expectations of the PD Session.	

	JHS (Elective): Develop student teachers' understanding of sequences and series and how to apply these concepts in other fields of mathematics (**Refer to PD Manual)** 1.6 Ask tutors in phase groups to discuss the important or distinctive aspects of the second lesson including vocabulary and fundamental concepts. **<u>Distinctive Aspect</u>** a. EG/UP/JHS (core) - Teacher beliefs about mathematics and their relation to teaching b. JHS (Elective) - Sequences and Series: Learning, teaching and applying. **<u>Vocabulary</u>** EG/UP/JHS (core): Examples: concept, Exposition, Implication Beliefs, Attitude Values **<u>Fundamental Concepts</u>** a. EG/UP/JHS (core • Teachers' beliefs about the teaching of mathematics • teachers' Attitude towards the teaching of mathematics • Values of teaching mathematics b. JHS (Elective) • Meaning and types of arithmetic sequences and series • Finding the general (nth)	1.6 In phase groups, discuss the distinctive aspects of the second lesson including vocabulary and fundamental concepts related to the components of the front matters. *NB: Possible questions from tutors to be addressed (Anticipated questions):* *I) How does teacher beliefs, teacher attitude and Teacher practices connect to influence effective teaching of Mathematics.* *II) How ways can sequence be explored?*	

	term of arithmetic sequences and series *NB: Possible questions from tutors to be addressed (Anticipated questions):* *I) How does teacher beliefs, teacher attitude and Teacher practices connect to influence effective teaching of mathematics.* *II) How ways can sequence be explored?*		
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group. **Familiar Concept** a.EG/UP/JHS (core): • Beliefs • Attitudes • Values b. JHS (Elective); • Counting • Sequence **Unfamiliar Concepts** a. EG/UP/JHS (core): e.g. • How teachers' attitudes influence the learning of Mathematics Concepts b. JHS (Elective): e.g. • Series • Finding the sum of the first n terms of arithmetic progression. 2.2 Lead tutors to draw connections among concepts in the various lessons in line with the Basic School Curriculum.	2.1 Identify familiar and unfamiliar concepts in their lessons and discuss with the larger group. 2.2 Draw connections among concepts in the various lessons in line with the basic school curriculum.	**15 mins**

	2.3 Ask tutors to outline possible challenging areas in (a) Teacher beliefs about mathematics and their relation to teaching. (b) Sequences and Series: Learning, teaching and applying. <u>Challenges</u> Some possible challenges for all Specialisms. Example JHS Specialism; The challenge involves in identifying the pattern 1, 8, 27, 48 has no pattern. *NB: Guide teachers to know the challenge involve in identifying pattern of some numbers.* 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. **Misconceptions** Example: EG/UP/JHS (core) Mathematics is not learnt but born with d. JHS(Elective) -**Sequences** and Series: Learning, teaching and applying- Triangular numbers and Sequence and Series follow the same rule or pattern. **Barriers** • Time • Learning Resources • Teacher Competence	2.3 Outline possible challenging areas in Teaching and Assessing, measurement of shape and space and in calculus taking into consideration GESI. (eg teacher makes sure to factor students learning styles in the teaching of the lesson) 2.4 Participate actively in the discussion on misconceptions and barriers in teaching and learning of the lesson	

	NB: Guide tutors to discuss how learning resource could be barrier to teaching and learning. 2.5 Support tutors to identify GESI responsive resources such as supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, Globe, mathematical set, manila cards, permanent markers, oranges and a knife. (NTS 3j, PD Manual pp.21)	*NB: Discuss how learning resource could be barrier to teaching and learning* 2.5 Identify as many GESI responsive resources such as supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, Globe, mathematical set, manila cards, permanent markers, oranges and a knife. (NTS 3j, PD Manual pp.21)	
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities for the lesson taking into account GESI issues. eg. i. Provision made for physically challenged ii. Both genders take leading roles in group task iii. Even distribution of questions to different categories of learners based on gender, ability, previous experience, etc NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Let tutors read the activities outlined in their course manuals and	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into consideration GESI 3.2 Read the activities outlined in your course manual and identify	**40 mins**

ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student	identify areas that require clarification. *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.* 3.3 Lead tutors to brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. eg. (a)EG/UP/JHS (core): **Strategy:** Expository and Discussion **Core Competencies:** Problem solving, critical and creative thinking and communication (b) JHS (Elective) **Strategy:** interactive and Collaborative group work (with the aid of ICT tools and other manipulatives explore the nth term of arithmetic progression. (ie. Un =(, where "a" is the first term, n is number of terms, d common difference and Un the general or indicated term). **Core Competencies**: Critical thinking skills and Collaborative learning 3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lessons	areas that require clarification. 3.3 Brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. 3.4 Discuss the assessment strategies to be used during teaching of the lesson – 'Assessment as' (NTS 3k).	

teachers	NB: *The assessment must involve Subject Project and Subject Portfolio (Teacher beliefs about mathematics and their relation to teaching (EG, UP, JHS (core) and* ***Sequences*** *and Series: Learning, teaching and applying)-JHS (Elective) Assessment must be aligned to the NTEAP and required course. Continuous assessment activities (assignments, quizzes, group presentations, etc, should be used to create subject projects and build subject portfolios (NTS 3k).* 3.5 Lead tutors to discuss the various ways they can support student teachers to build their project and subject portfolio. 3.6 Let a tutor model a presentation of an activity using ICT tools and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups and in the demonstration of the use of ICT tools) to teach their lessons EG, UP JHS(Core)- similarities and differences among values, attitudes, and beliefs and how these impact learning	 3.5 Discuss the various ways they can support student teachers to build their project and subject portfolios 3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons **(**NTS 1a, b, 2b, e, 3b, c, J; BSC pp. 23)	

	JHS (Elective)- Finding the sum of the first n terms of arithmetic progression. *Example*: **The sum of** n **and (**n − 1**) terms of an AP is 441 and 356 respectively. If the first term of the AP is 13 and the common difference is equal to the number of terms, find the common difference of the AP.** **(** NTS 1a, b, 2b, e, 3b, c, J; BSC pp. 23 PD manual 21) NB: *Guide tutors to use the internet to find the formular for finding the sum of the first n terms of arithmetic progression*		
4. Evaluation and review of session: • Tutors should Identifying critical friends to observe lessons and report at next session. • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Reflective Activity** 4.1 Engage tutors in self-evaluation as well as encourage tutors to provide feedback of the PD session taking into consideration inclusivity – how to be patient with Stammerers, using tactile and audio devices for visually challenged, paying attention to all courses, etc. Ask tutors to show by fingers/nods their level of satisfaction with the session. (NTS 1a, 3i).	**Reflective Activity** 4.1 Show by fingers/nods of 5 or 3 or 1 as to those who “really got it”, “got some of it” or “didn’t get it” respectively. Explain if you really got the lesson	**15 mins**

	4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification *Take note of all unresolved issues and use any of following strategies* – *put on SL/SWL WhatsApp platform for discussion* – *tutors to research for the next PD session for discussion* *4.3* Ask a critical friend to observe your teaching and record his/her findings to be presented after delivery or in the Next PD session. *NB: Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* **Advance Preparation** 4.4 Ask tutors to read Lesson 3 of the Course Manual on: **Early Grade** – Beliefs underlying the current Early Grade Official curriculum and inclusive Classroom practice: **Upper Primary** - Beliefs underlying the current Upper Primary Official curriculum and inclusive Classroom practice **JHS(Core)-** Beliefs underlying the current JHS Official	4.2 Reflect on the activities in the session and outline unresolved issues relating to the lesson. 4.3 Identify a critical friend observes teaching and record his/her findings to be presented after delivery or in the Next PD session. *NB: Identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* **Advance Preparation** 4.4 Read Lesson 3 of the Course Manual on: **Early Grade** – Beliefs underlying the current Early Grade Official curriculum and inclusive Classroom practice: **Upper Primary** - Beliefs underlying the current Upper Primary Official curriculum and inclusive Classroom practice **JHS(Core)-** Beliefs	

	curriculum and inclusive Classroom practice **JHS(Specialism)** – Sequence and Series-Teaching, Learning and applying. N/B *Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification. Collect all-inclusive resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLMs you may need and*	underlying the current JHS Official curriculum and inclusive Classroom practice **JHS(Specialism)** – Sequence and Series-Teaching, Learning and applying.	

Age Levels/s:	Name of Subject/s:
a. Early Grade	a. Theories in the learning of Numeracy
b. Upper Grade	b. Theories in the Learning of Mathematics Upper Primary
c. JHS (Core)	c. Theories in the learning of JHS Mathematics
d. JHS (Elective)	d. Maths (JHS) – Further Algebra

Tutor PD Session for Lesson 3 in the Course Manual

Lesson Tittle:

a. Early Grade - *Beliefs underlying the current Early Grade Official Curriculum and Inclusive Classroom Practice*

b. Upper Grade -*Beliefs underlying the current Upper Primary Official Curriculum and Inclusive Classroom Practice*

c. JHS (CORE)-*Beliefs Underlying the Current Junior High School Official Curriculum and Inclusive Classroom practice.*

d. JHS (Elective) - Sequences and Series: Learning, Teaching and Applying 2

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1. Introduction to the session • Review prior learning • A critical friend to share findings for a short discussion and lessons learned • Reading and discussion of the	**Introduction** 1.1 Ice breaker activity: Begin an activity that involve skip counting by asking tutors to start with any number. 1.2 Ask tutors to tell in their phase group how useful the previous PD session	**Introduction** 1.1. Continue the patterns with the next term: example 2, 4, 6, 8. 1.2 Discuss in your phase group with your friend how useful the previous	**20 mins**

<table>
<tr>
<td>introductory sections of the lesson up to and including learning outcomes and indicators
• Overview of content and identification of any distinctive aspects of the lesson/s,
NB The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson.
NB SL/HoD should ask tutors to plan for their teaching as they go through the PD session</td>
<td>was and how it influenced their teaching and learning. For example:

<table><tr><th>EG</th><th>UP</th><th>JHS (Core)</th></tr><tr><td colspan="3">Beliefs underlying the current Grade Official Curriculum and Inclusive Classroom Practice</td></tr><tr><td colspan="3">JHS (Elective)</td></tr><tr><td colspan="3">Sequences and Series: Learning, Teaching and Applying 2</td></tr></table>
1.3 Ask a critical friend to give a feedback on observation during enactment of the second (2nd) lesson.

NB: Things tutor might have observed; tutor's choice of words, pedagogical content knowledge, content knowledge subject matter, ICT tools, GESI and the use of NTEAP

1.4 Ask tutors to read and discuss the introductory section of the lesson including the learning outcomes (LOs) in phase groups.

NB: Make reference to the Course Manual, NTS and salient points necessary for</td>
<td>PD session was and how it influenced your teaching and learning. For example:

<table><tr><th>EG</th><th>UP</th><th>JHS (Core)</th></tr><tr><td colspan="3">Beliefs underlying the current Grade Official Curriculum and Inclusive Classroom Practice</td></tr><tr><td colspan="3">JHS (Elective)</td></tr><tr><td colspan="3">Sequences and Series: Learning, Teaching and Applying 2</td></tr></table>
1.3 As a critical friend share observation on the second (2nd) lesson.

NB: Your observation should inclusion choice of words, pedagogical content knowledge, content knowledge subject matter, ICT tools, GESI and the use of NTEAP

1.4 Read and Discuss the introductory section of the lesson (up to learning outcomes). Suggest relevant previous knowledge of students that will support effective teaching and learning of the lesson.</td>
<td></td>
</tr>
</table>

	the development of their proforma. 1.5 Ask tutors to scan through the course manual in their phase group and identify the purpose of the lesson and state their expectations of the PD Session. 1.6 Lead tutors to mention how students were well placed to employ the various strategies and skills during the Basic School classroom work including STS Field Experience. 1.7 Ask tutors in their phase groups to discuss the important or distinctive aspects of the third lesson including vocabulary and fundamental concepts. *For example:* *a. Teacher's beliefs underlying the current official grade level (Early Grade, Upper Grade, JHS) curriculum and inclusive classroom practice.* *b. JHS- Learning, teaching and applying Sequences and Series* *Distinctive aspects include*	***NB***: refer to Course Manual, *NTS and salient points necessary for the development of your proforma.* 1.5 Identify the purpose of the lesson from the course manual in your phase group and state your expectations of the PD Session. 1.6 Mention how students were well placed to employ the various strategies and skills during the Basic School classroom work including STS Field Experience 1.7 In your phase groups, discuss the distinctive aspects of the third lesson including vocabulary and fundamental concepts. *For example:* *a. Teacher's beliefs underlying the current official grade level (Early Grade, Upper Grade, JHS) curriculum and inclusive classroom practice.* *b. JHS- Learning, teaching and applying Sequences and Series* *Distinctive aspects include*	

	the interactive nature of the activities, emphasis on connecting concepts: *a. Early, Upper Prim & JHS (Core) Grade: – eg. Teacher's Beliefs, Teacher's Attitude and Teacher's Practices* *b. JHS; Further Algebra – eg. Misconceptions, barriers, meaning and types of geometric sequences and series;* ***NB:** Possible questions from tutors to be addressed (**Anticipated questions**):* *i. Anticipated questions:* *ii. Which methods of teaching Mathematics at the EG/UP/JHS is good?* *iii. How do we integrate ICT teaching Mathematics at the EG/UP/JHS?* *iv. How best does one introduce the connect sequence to series to JHS (Elective)?* *NB: Guide tutors to discuss the possible answers to the anticipated questions, bearing in mind pedagogy, GESI, ICT – E.g. the most appropriate methods depend on age and previous knowledge of learners, objective of lesson, etc.*	*the interactive nature of the activities, emphasis on connecting concepts:* *a. Early, Upper Prim & JHS (Core) Grade: – eg. Teacher's Beliefs, Teacher's Attitude and Teacher's Practices* *b. JHS; Further Algebra – eg. Misconceptions, barriers, meaning and types of geometric sequences and series*	
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new	**Concept Development** 2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group.	**Concept Development** 2.1 Identify familiar and unfamiliar concepts in your lesson(s) and discuss with the larger group.	**15 mins**

learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	***Familiar concepts***: *addition, number, numeracy, shapes, sequence, series, limit* ***Unfamiliar Concept:*** *divergence* 2.2 Lead tutors to draw connection(s) among concepts in the various lessons in line with the Basic School Curriculum (*BSC*). *Example: The connection between addition and subtraction is that one is the inverse of the other, sequence and series.* 2.3 Ask tutors to outline possible challenging areas in: (c) Teacher beliefs about current basic school mathematics curriculum and classroom inclusion practice. (d) Learning, teaching and applying sequences and series: Taking GESI consideration (eg. Teacher ensure learning styles of students are inculcated in the teaching of the lesson and experience from STS). 2.4 Lead tutors in their phase group to discuss misconceptions and barriers in teaching and learning of the lesson. ***Example of misconception****: Mathematics is not learnt*	2.2 Draw connection(s) among concepts in the various lessons in line with the Basic School Curriculum (*BSC*). 2.3 Outline possible challenging areas in teaching of beliefs about current basic school mathematics curriculum and classroom inclusion practice and Learning, teaching and applying sequences and series: taking into consideration GESI. (eg. Teacher makes sure to factor students learning and teaching styles in the teaching of the lesson and differentiated approach as experienced from STS). 2.4 Discuss in your phase group some misconceptions and barriers to teaching and learning the lesson and share them with the larger group.	

	but born with JHS(Elective) Sequences and Series: Learning, teaching and applying ***Example of challenge**: identifying the pattern 2, 16, 54, 96 has no pattern.* ***Barriers** may include poor previous knowledge, lack of adequate resources, lack of opportunities to use ICTs due to power failure (lighting), uninterrupted network, unavailability of Internet package for students, insufficient contact time due to staff meetings.* ***NB:** Guide teachers through the challenge of identifying trends in some numbers.* 2.5 Support tutors to identify GESI responsive resources such as supporting staff with experts in sign language as well as resources such as teacher and learner resource packs, textbooks, course manual, recorded video, Globe, mathematical set, manila cards, permanent markers, oranges and a knife. (NTS 3j, PD Manual pp.21)	2.5 Identify as many GESI responsive resources such as supporting staff with experts in sign language as well as resources such as teacher and learner resource packs, textbooks, course manual, recorded video, Globe, mathematical set, manila cards, permanent markers, oranges and a knife. (NTS 3j, PD Manual pp.21)	
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and	**Teaching and learning activities** 3.1 Have tutors suggest teaching and learning activities for the lesson taking into account GESI issues.	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into consideration GESI	**40 mins**

learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they	*Example:* *i. Provision made for learners with learning needs and physical handicaps.* *ii. Both genders take a leading role in group tasks.* *iii. Even the distribution of questions to different classes of learners based on gender, capacity, past experience, etc.* *NTS 1a, b, c, d, 2b, e, f, 3b, c* 3.2 Let tutors read the activities outlined in their course manuals and identify areas that require clarification. Strategies for clarifying otherwise gloomy points can include investigation, internet search, etc. ***NB:*** *Ask tutors to refer to the Basic School Curriculum (BSC pp. xv – xvii) and* http://uk.sagepub.com *for explanations on "Why do we teach mathematics in school?" and search through "IXL Math" and GeoGebra to clarify the otherwise dark spots in "Further Algebra".* 3.3 Lead tutors to brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. eg. (a) Early Grade, Upper primary and JHS (Core)	3.2 Read the activities described in the course manual and identify areas for clarification. ***NB****: Refer to the Basic School Curriculum (BSC pp. xv – xvii) and http://uk.sagepub.com for explanations on "Why do we teach mathematics in school?" and search through "IXL Math" and GeoGebra to clarify the otherwise dark spots in "Further Algebra.* 3.3 Brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners.	

should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	**Strategy: Expository and Discussion** **Core Competencies:** Problem solving, critical and creative thinking and communication (b) JHS Specialism **Strategy:** Use interactive and Collaborative group work (with the aid of ICT tools and other manipulatives to explore the nth term of Geometric progression. (ie. $a_n = a_1 r^{n-1}$, where "a" is the first term, n is number of terms, r is common ratio and a_n the general or indicated term). **Core Competencies**: Critical thinking skills and Collaborative learning 3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lessons (assessment 'as' and 'for'). *NB: Continuous assessment activities (assignments, quizzes, group presentations, etc. should be used to create subject projects and build subject portfolios).* *E.g. A project on how children learn using the behaviourist, cognitivist and constructivist approach. (EG, UP, JHS-Core)* *A project on investigation of limit of sequences and series*	3.4 Discuss the assessment strategies to be used during teaching of the lesson (assessment 'as' and 'for' -NTS 3k). *NB: Continuous assessment activities (assignments, quizzes, group presentations, etc. should be used to create subject projects and build subject portfolios).* *E.g. A project on how children learn using the behaviourist, cognitivist and constructivist approach. (EG, UP, JHS-Core)*	

	and its application to real life (JHS-Elective). 3.5 Lead tutors to discuss the various ways they can support student teachers to build their project and subject portfolio. 3.6 Let a tutor model a presentation of an activity using ICT tools and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups and in the demonstration of the use of ICT tools) to teach their lessons EG, UP JHS(Core)- similarities and differences among values, attitudes, and beliefs and how these impact learning JHS (SP)- Finding the sum of the first n terms of geometric progression. *Example***:** *The sum of* ***n*** *and (****n–1****) terms of an GP is 10 and 270 respectively. If the first term of the GP is 10 and the fourth term is 270, find the common ratio of the GP.* **(**NTS 1a, b, 2b, e, 3b, c, J; BSC pp. 23 PD manual 21)	*A project on investigation of limit of sequences and series and its application to real life (JHS-Elective).* 3.5 Discuss the various ways they can support student teachers to build their subject project and subject portfolios 3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons **(**NTS 1a, b, 2b, e, 3b, c, J; BSC pp. 23)	

	NB: *Guide tutors to use the internet to find the formular for finding the sum of the first n terms of arithmetic progression*		
4. Evaluation and review of session: • Tutors should Identifying critical friends to observe lessons and report at next session. • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Reflective Activity** 4.1 Engage tutors in providing feedback of the PD session taking into consideration – Clarity of concepts, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi) and make notes that will help them to teach Lesson 4. 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification. ***NB:*** *Take note of all unresolved issues that may need further research or consultation and use any of following strategies to address them.* *i. put on SL/SWL WhatsApp platform for discussion* *ii. tutors to research for the next PD session for discussion* 4.3 Ask tutors to identify a critical friend from the same or related discipline to observe the enactment of their lesson and provide	**Reflective Activity** 4.1 Reflect and provide feedback on this PD session taking into consideration – Clarity of concepts, pedagogical approaches employed, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi)? and make notes that will help you to teach Lesson 4. 4.2 Reflect and identify unresolved issues relating to this lesson for clarification. ***NB***: *Put your unresolved issues unto* the department's *WhatsApp/ Telegram platform and research into the issues raised.* 4.3 Identify a critical friend in the same or related discipline to observe your lesson and give feedback during the next PD session (NTS 1a).	**15 mins**

	feedback during the next PD Session (NTS 1a). *NB: take note of all unresolved issues and use any of following strategies* *i. put on SL/SWL WhatsApp platform for discussion* *ii. tutors to research for the next PD session for discussion* **Advance Preparation** 4.4 Ask tutors to remember to prepare proforma for Lesson 4 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 4 of the Course Manual on: **Early Grade** – Beliefs underlying the current Early Grade Official curriculum and inclusive Classroom practice 2; **Upper Primary** - Beliefs underlying the current Upper Primary Official curriculum and inclusive Classroom practice 2; **JHS(Core)-** Beliefs underlying the current JHS Official curriculum and inclusive Classroom practice 2; **JHS(Specialism)** – Quadratic Functions -Teaching, Learning and applying. *NB:* *i. Read the course manual the PD session guide, NTS, and NTEAP ahead of time*	 **Advance Preparation** 4.4 Remember to prepare proforma for the Lesson 4 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 4 of the Course Manual on: **Early Grade** – Beliefs underlying the current Early Grade Official curriculum and inclusive Classroom practice 2; **Upper Primary** - Beliefs underlying the current Upper Primary Official curriculum and inclusive Classroom practice 2; **JHS(Core)-** Beliefs underlying the current JHS Official curriculum and inclusive Classroom practice 2; **JHS(Specialism)** – Quadratic Functions -Teaching, Learning and applying. *NB:* *i. Take note of the PD session guide, NTEAP, and NTS ahead of time to identify*	

	to identify any outstanding issues relating to the lesson for clarification. *ii. Collect all-inclusive resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLMs you may need and rehearse how these may be used to support the achievement of your goals.*	*any outstanding issues relating to the lesson for clarification.*	

Age Levels/s:

a. Early Grade
b. Upper Grade
c. JHS (Core)
d. JHS (Elective)

Name of Subject/s:

a. Theories in the Learning of Numeracy in Early Grade
b. Theories in Learning upper primary mathematics
c. Theories in Learning of Jnr High School Math.
d. Further Algebra

Tutor PD Session for Lesson 4 in the Course Manual

Lesson Title:

a. Early Grade -Beliefs underlying the current Early Grade official curriculum and inclusive classroom practice 2
b. Upper Grade-Beliefs underlying the current Upper primary official curriculum and inclusive classroom practice 2
c. JHS (**Core)-**Beliefs underlying the current JHS official curriculum and inclusive classroom practice 2
d. JHS(**Specialism**) -Quadratic functions: *Learning, teaching and applying*

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1. Introduction to the session • Review prior learning • Reading and discussion of the introductory sections of the lesson up to and including learning	1.1 Icebreaker activity: Begin with an investigational activity according to the subjects and age phases. Eg i. An exposition on how one's belief system can affect the teaching of and established scientific	1.1 Ice breaker activity: Begin with an investigational activity according to the subjects and age phases Eg. i. An exposition on how one's belief system can affect the teaching of an established scientific fact	**20 mins**

outcomes and indicators • Overview of content and identification of any distinctive aspects of the lesson/s, NB The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson. NB SL/HoD should ask tutors to plan for their teaching as they go through the PD session	fact in inclusive classroom ii. Demonstrate how everyday activity could be reduce to a quadratic function 1.2 Ask tutors to tell how useful the previous PD session was and how it influenced their teaching in lesson 3. 1.3 Expose tutors to the overview of the subject age phases to be covered in this PD session and how it will be organised. *i.* ***Early and upper grade and JHS (Core)*** *lessons focus on Philosophies of mathematics and mathematics education and explores trainee teachers' beliefs about mathematics and philosophies of mathematics implicit the official mathematics curriculum and current classroom practice. It also covers children's developmental levels, how children learn mathematics and associated theories, and other psychological factors influencing learning* *ii.* ***JHS (Maths Specialism)*** *lesson seeks to develop student teachers' conceptual understanding of quadratic equations in*	in inclusive classroom ii. Demonstrate how everyday activity could be reduce to a quadratic function 1.2 Discuss how useful the previous PD session influenced their teaching over the week. 1.3 Participate in the discussion on the overview of the subject age phases to be covered in this PD session and how it will be organised.	

	order to prepare them to handle future mathematics classroom with respect to quadratic equations, their applications and other related concepts. 1.4 Ask a critical friend to give feedback on observation during the enactment of lesson 3. 1.5 Ask tutors to suggest the purpose of the lesson and state their expectations of the PD Session. 1.6 Guide tutors to establish the linkage between CLOs and the LOs of the lesson for each of the Phases 1.7 Ask tutors in phase groups to discuss the important or distinctive aspects of the lesson including vocabulary and fundamental concepts. ***Distinctive aspects*** *includes the interactive nature of the activities, emphasis on connecting concepts:* *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *– eg. Exploration of trainee teachers' beliefs about mathematics and philosophies of*	1.4 Participate in the critiquing of the feedback on observation during the enactment of lesson 3. 1.5 Engage tutors to suggest the purpose of the lesson and state your expectations of the PD Session. 1.6 Participate in the linkage of the CLOs and the LOs of the lesson for each of the phases 1.7 In pairs discuss the distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters.	

	mathematics as indicated in the official mathematics curriculum and current classroom practice. *b.* ***JHS (Further Algebra):*** *– eg. Linking sequence obtained from everyday activities to the construction of quadratic equation.* **N/B** *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *i. Why the need to rewrite quadratic equation in other forms?* *ii. How can a tutor control or positively influence the beliefs of learning mathematics?*		
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	**Concept Development (New learning likely to arise in lesson/s)** 2.1 Ask tutors to identify familiar and unfamiliar concepts in the lesson and discuss with the larger group 2.2 Lead tutors to draw connections among concepts in the various lessons in line with the basic school curriculum Example: ***Early, Upper Prim & JHS (Core) Grade:-*** Implications for classroom practice relative to understanding learning	**Concept Development (New learning likely to arise in lesson/s)** 2.1 Participate in the identification of familiar and unfamiliar concepts in the lesson and discuss with the larger group. 2.2 Draw connections among concepts in the various lessons in line with the basic school curriculum. Example: ***Early, Upper Prim & JHS (Core) Grade:-*** Implications for classroom practice relative to understanding learning	**15 mins**

	difficulties in mathematics ***JHS (Further Algebra):*** – connections between algebraic, tabular, and graphical representations of quadratic functions 2.3 Ask tutors to use Think-Pair-Share to outline possible challenging areas in teaching and assessing of; *a.* ***Early, Upper Prim & JHS (Core) Grade:*** – Beliefs underlying the current official curriculum and inclusive classroom practice. *b.* ***JHS; Further Algebra*** Quadratic functions: Learning, teaching and applying. **N/B** Eg. *The use of differentiated instruction to cater for the needs of all children in the early and upper grade and JHS classrooms, including those with special educational needs (SEN) and creating a safe, secure, happy and stimulating learning environment (NTS 3c 3f, pg. 14)* 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson Example: <u>Misconceptions</u>	difficulties in mathematics ***JHS (Further Algebra):*** – connections between algebraic, tabular, and graphical representations of quadratic functions 2.3 Individually, outline the challenging areas in your lesson, share with a member of the same phase group and then with the whole group. *a.* ***Early, Upper Prim & JHS (Core) Grade:*** – Beliefs underlying the current official curriculum and inclusive classroom practice. *b.* ***JHS; Further Algebra*** Quadratic functions: Learning, teaching and applying. 2.4 Participate in the discussion on misconceptions and barriers in teaching and learning of the lesson	

	a. ***Early, Upper Prim & JHS (Core) Grade:*** – i) Mathematics is meant for people with high spiritual linkage ii) mathematics are for boys not girls. b. **JHS (Sp)** : letters/variables in an equation are not related to real life. <u>Barriers</u> may include weak prior knowledge, lack of appropriate resources, lack of opportunity to use ICT due to failure of electric power (lights-out), bad/weak network, unavailability of internet bundle for students, inadequate contact time due to staff meetings, Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about the lesson.		
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for	**Planning for teaching, learning and assessment activities for the lesson/s** 3.1 In their phase groups, ask tutors to suggest teaching and learning activities for the lesson. i. Provision is made for physically challenged persons and persons with other forms of disability ii. Both genders take leading roles in group task	**Planning for teaching, learning and assessment activities for the lesson/s** 3.1 Suggest teaching and learning activities for the lesson.	

making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which	iii. Even distribution of questions to different categories of learners based on gender, ability, previous experience, etc. referring to NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Ask tutors to go through the lesson in the course manual and identify areas that require clarification. *Eg.* *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.* 3.3 Ask tutors to brainstorm and explain how a. beliefs underlying the current official curriculum and inclusive classroom practice b. relating real life problem to quadratic functions, can improve on the learners understanding of the lesson. Refer to Basic School Curriculum (BSC pp. xv – xvii) 3.4 Lead tutors to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. eg. (a)EG/UP/JHS (core):	3.2 Read the activities outlined in your course manual and identify areas that require clarification 3.3 Brainstorm and explain how a. beliefs underlying the current official curriculum and inclusive classroom practice b relating real life problem to quadratic functions, can improve on the learners understanding of the lesson. Refer to Basic School Curriculum (BSC pp. xv – xvii) 3.4 Suggest some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners.	

need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	**Strategy:** Expository, inquiry and discussion: to explore the effect of teachers' attitudes on the learning and teaching of mathematics **Core Competencies:** problem formulation and identification, Problem solving, critical and creative thinking and communication (b) JHS Specialism **Strategy:** interactive and Collaborative group work (with the aid of ICT tools and other manipulatives to examine nature and types of quadratic functions and investigate quadratic functions and its graphs. **Core Competencies**: Critical thinking skills and Collaborative learning 3.5 Ask tutors to mention some GESI responsive resources that can be used with the suggested approaches and strategies in achieving the LOs. **E.g.** *Resources may include supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, prisms, pyramids, projectors, flip charts, sticky notes, braille, tactile materials, audio and*	3.5 Mention some GESI responsive resources that can be used with the suggested approaches and strategies in achieving the LOs. ***E.g*** *Resources may include supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, etc*	

	audio-visuals that can be used in the teaching and learning of the concepts mentioned above (NTS 3j) 3.6 Ask tutors to identify and discuss continuous assessment for the lesson to support student teacher learning (NTS 3k). *N/B:* *Assessment must be aligned to the NTEAP and required course Assessment to include subject project, subject portfolio and end of semester examination* Eg. Example: **Early, Upper Primary and JHS (Core) Grades** – Interview about 10 basic school teachers during the STS activity on mathematics that basic school learners are exposed to a) at home & b) during play **JHS Grade** – In groups of four, develop any game for teaching any concept within your course outline on quadratic functions. 3.7 Lead tutors to discuss the various ways they can support student teachers to build their subject portfolio. *E.g. encouraging student teachers to file all their assignments with feedback in their folders.* *Taking notes in class and*	3.6 Identify and discuss continues assessment strategies for the lesson to support student teacher learning (NTS 3k). Eg. Example: **Early, Upper Primary and JHS (Core) Grades** – Interview about 10 basic school teachers during the STS activity on mathematics that basic school learners are exposed to a) at home & b) during play **JHS Grade –** In groups of four, develop any game for teaching any concept within your course outline on quadratic functions. 3.7 Lead tutors to discuss the various ways they can support student teachers to build their subject portfolio *E.g. encouraging student teachers to file all their assignments with feedback in their folders.*	

	filing them 3.8 Ask a tutor to model a presentation of an activity using projector, internet search and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups) NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii	3.8 Model a presentation of an activity using projector, internet search and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups) NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii	
4. Evaluation and review of session: • Tutors need to identify critical friends to observe lessons and report at next session • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Evaluation and review of session:** 4.1 Engage tutors in providing feedback of the PD session taking into consideration – Clarity of concepts, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi) and make notes that will help them to teach Lesson 4 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification. ***N/B:*** *Take note of all unresolved issues that may need further research or consultation and use any of following strategies to address them.* *i. put on SL/SWL WhatsApp platform for discussion* *ii. tutors to research for the next PD session for discussion*	**Evaluation and review of session:** 4.1 Reflect and provide feedback on this PD session taking into consideration – Clarity of concepts, pedagogical approaches employed, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi)? and make notes that will help you to teach Lesson 4 4.2 Identify unresolved issues relating to this lesson for clarification. N/B: *Put your unresolved issues unto* the department's *WhatsApp/ Telegram platform and research into the issues raised.*	**15 mins**

	4.3 Ask tutors to identify a critical friend from the same or related discipline to observe the enactment of their lesson and provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Ask tutors to remember to prepare proforma for Lesson 5 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 5 of the Course Manual on: <u>Early Grade</u> – Major theories of learning in Early Grade mathematics in inclusive classrooms <u>Upper Primary</u> - Major theories of learning in Upper primary mathematics in inclusive classrooms <u>JHS(Core)</u> - Major theories of learning in Junior High School mathematics in inclusive classrooms <u>JHS(Sp.)</u> – Quadratic functions: *Learning, teaching and applying 2* N/B *i. Read the course manual and the PD session guide ahead of time to identify any outstanding issues relating to the lesson for*	4.3 Identify a critical friend from the same or related discipline to observe the enactment of your lesson and to provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Remember to prepare proforma for the Lesson 5 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 5 of the Course Manual on: <u>Early Grade</u> – Major theories of learning in Early Grade mathematics in inclusive classrooms <u>Upper Primary</u> - Major theories of learning in Early Grade mathematics in inclusive classrooms <u>JHS(Core)</u> - Major theories of learning in Early Grade mathematics in inclusive classrooms <u>JHS(Sp.)</u> – Quadratic functions: *Learning, teaching and applying 2* N/B *i. Take note of the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.*	

	clarification. *ii. Collect needed resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLRs you may need and rehearse how these may be used to support the achievement of your goals*		

Age Levels/s:	Name of Subject/s:
a. Early Grade	a. Theories in the Learning of Numeracy in Early Grade
b. Upper Grade	b. Theories in Learning upper primary mathematics
c. JHS (Core)	c. Theories in Learning of Jnr High School Math.
d. JHS (Elective)	d. Further Algebra

Tutor PD Session for Lesson 5

Lesson Tittle:

a. Early Grade - Major theories of learning and teaching of Early Grade mathematics in inclusive classrooms

b. Upper Grade - Major theories of learning and teaching of Upper primary mathematics in inclusive classrooms

c. JHS (CORE) - Major theories of learning and teaching of Junior High School mathematics in inclusive classrooms

d. JHS (Elective) - Quadratic functions: Learning, teaching and applying 2

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1. Introduction to the session • Review prior learning • A critical friend to share findings for a short discussion and lessons learned • Reading and discussion of the	**Introduction** 1.1 Ice breaker activity: Ask tutors to share any experience they have had with a mathematics teacher during their early school days which has influences their perception of the subject	**Introduction** 1.1 Share your experience they have had with a mathematics teacher during their early school days which has influences their perception of the subject	**20 mins**

introductory sections of the lesson up to and including learning outcomes and indicators • Overview of content and identification of any distinctive aspects of the lesson/s, NB: The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson. NB: SL/HoD should ask tutors to plan for their teaching as they go through the PD session	1.2 Ask tutors to tell how useful the lesson 4 PD session was and how it influenced their teaching over the week. Lead them to mention how students were well placed to employ the various strategies and skills during the Basic School classroom work including STS Field Experience. N/B: *Draw tutors' attention to all NTS references and salient points necessary for the development of their proforma.* 1.3 Ask the critical friend to give feedback on his/her observation of the last enacted lesson laying emphasis on clarity of concepts explained, assessment strategies, ICT integration, GESI, Twenty First Century Skills. 1.4 Lead tutors to discuss any challenges that arose during the enactment. Eg In what ways did explanations obtained by students through internet search complicate understanding of concepts? 1.5 Ask tutors to read individually and discuss	1.2 Tell how useful the previous PD session was and how it influenced your teaching over the week. Explain how students were well placed to employ the strategies and skills during Basic School classroom work including STS Field Experience. N/B: *Pay attention to NTS references and salient points necessary for the development of their proforma.* 1.3 As a critical friend, describe how the previous lesson observed went laying emphasis on clarity of concepts explained, assessment strategies, ICT integration, GESI, Twenty First Century Skills. 1.4 Discuss any challenges that arose during the enactment. 1.5 Read individually and discuss the introductory	

	in pairs the introductory sections of the lesson up to Learning Outcomes. 1.6 Lead tutors in pairs to discuss the distinctive aspects of lesson 5 such as fundamental concepts and developing awareness of equity and diversity issues and issues on ICT. ***Distinctive aspects*** *include the interactive nature of the activities, emphasizing on connecting concepts:* *a. Early Grade– eg. Connections between the theoretical perspectives and learning of mathematics in early grade* *b. Upper Grade – eg. Connections between the theoretical perspectives and learning of mathematics in upper primary* *c. JHS (Core) – eg. Connections between the theoretical perspectives and learning of mathematics in Junior High School* *d. JHS (Specialism) – eg. solving quadratic equations, graphing quadratic equations, roots of quadratic equations and quadratic inequalities* N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:***	sections of the lesson up to Learning Outcomes. 1.6 In pairs, discuss the distinctive aspects of lesson 5 such as fundamental concepts and developing awareness of equity and diversity issues and issues on ICT. ***Distinctive aspects*** *include the interactive nature of the activities, emphasizing on connecting concepts:* *a. Early Grade– eg. Connections between the theoretical perspectives and learning of mathematics in early grade* *b. Upper Grade – eg. Connections between the theoretical perspectives and learning of mathematics in upper primary* *c. JHS;(Core)– eg. connections between the theoretical perspectives and learning of mathematics in Junior High School* *d. JHS (Specialism) – eg. solving quadratic equations, graphing quadratic equations, roots of quadratic equations and quadratic inequalities*.	

<table>
<tr>
<td></td>
<td>i. What are the weakness of the theories of learning of basic school mathematics?
ii. What are the likely RPK to for solving quadratic equations?
NB: Guide tutors to discuss the possible responses to the anticipated questions, bearing in mind pedagogy, GESI, ICT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Concept Development (New learning likely to arise in lesson/s):
• Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD
NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors</td>
<td>Concept Development
2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group.
<table>
<tr><th>Familiar Concepts</th><th>Unfamiliar concepts</th></tr>
<tr><td>Quadratic equations</td><td>Roots of quadratic equation</td></tr>
<tr><td>Information about J. Piaget and J. Bruner</td><td>Information about J. H. Pestalozzi</td></tr>
</table>
2.2 Lead tutors to draw connections among concepts in the various lessons in line with the basic school curriculum.
Example: Early/Upper Primary/JHS core - Activity theory perspectives and SBC pp. xv-xvi
JHS (Specialism) – Linking Distributive property / factorization in JHS and factorizing quadratic expressions.

2.3 Ask tutors to use Think-Pair-Share to outline possible challenging</td>
<td>Concept Development
2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group.

2.2 In your phase groups, draw connections among concepts in the lesson and in line with the basic school curriculum.

2.3 Individually, outline the challenging areas in your lesson, share with a</td>
<td>15 mins</td>
</tr>
</table>

	areas in teaching and assessing the lesson. 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. *Example:* *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *–* *Some people are born with Mathematics and so they easily understand lessons.* *b.* ***JHS (Elective)*** *–* *Quadratic expressions always have 3 terms.* **Barriers:** *Poor foundational knowledge about quadratic equations while in SHS. Lack of appropriate resources, lack of opportunity to use ICT due to failure of electric power (lights-out), bad/weak network, unavailability of internet bundle for students and emergency academic staff meetings.*	member of the same phase group and then with the whole group. 2.4 In whole group, discuss any misconceptions and barriers in teaching and learning of the lesson.	
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may	**Planning for teaching, learning and assessment activities** 3.1 In their phase groups, ask tutors to suggest teaching and learning activities for the lesson ensuring; i. Provision is made for SEN ii. Both genders take leading roles in group task	**Planning for teaching, learning and assessment activities** 3.1 In your phase groups, ask tutors to suggest teaching and learning activities for teaching the lesson ensuring; i. Provision is made for SEN ii. Both genders take leading roles in group task, etc	**40 mins**

require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point	iii. Even distribution of questions to different categories of learners based on gender, ability, previous experience, etc. referring to NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Ask tutors to read the activities outlined in their course manuals and identify areas that require clarification. NB: *Refer to https://www.21caf.org and* https://www.researchgate.net *for explanations on "Connections between the theoretical perspectives and learning of mathematics" and search through https://www.mathsisfun.com to clarify the otherwise dark spots in "Quadratic Equations".* 3.3 Lead tutors to brainstorm to come up with some pedagogical approaches and their impact on learning of the concepts taking into consideration inclusivity. *Example: i) The use of inquiry to explore Connections between the theoretical perspectives and learning of mathematics. (ii) The use of differentiation and scaffolding to ensure that no learner is left behind (SBC pp. xv)*	referring to NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Read the activities outlined in your course manuals and identify areas that require clarification. NB: *Refer to https://www.21caf.org &* https://www.researchgate.net *for explanations on "Connections between the theoretical perspectives and learning of mathematics" and search through https://www.mathsisfun.com to clarify the otherwise dark spots in "Quadratic Equations". dark spots in "Quadratic Equations".* 3.3 Brainstorm to come up with some pedagogical approaches that can be employed during the lesson and their effectiveness towards learning of the concepts. Mention any GESI issues that need consideration while using those approaches	

presentations, TLM or other resources which need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	*Engage students in meaningful "hands-on" activities to explore roots of Quadratic Equations* *iii) Being patient with stutterers, using tactile or braille for visually challenged, providing peer support for those who might need, while you pay attention to all Phases.* 3.4 Ask tutors to explain some suggested teaching strategies that can help inculcate core competencies in student teachers and for that matter Basic School learners. *eg. Using a)* ***Internet Search*** *to identify the Connections between the theoretical perspectives and learning of Mathematics –use of* ***ICT Skills*** *b)* ***Exploring*** *quadratic roots by graphing quadratic equations –* ***Critical Thinking*** 3.5 Ask tutors to mention some GESI responsive resources that can be used with the suggested approaches and strategies in achieving the LOs. **E.g.** *Resources may include supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, projectors,*	3.4 Suggest teaching strategies to be used in achieving the LOs of the lesson and explain how they can help inculcate core competencies in student teachers and for that matter Basic School learners. 3.5 Mention some GESI responsive resources that can be used with the suggested approaches and strategies in achieving the LOs. **E.g.** *Resources may include supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, etc*	

	flip charts, sticky notes, braille, tactile materials, audio and audio-visuals that can be used in the teaching and learning of the concepts mentioned above (NTS 3j) 3.6 Using discussion, lead tutors to come out with assessment strategies ('as' and 'for') to be used during teaching of the lesson. *NB: Continuous assessment activities (assignments, quizzes, group presentations, etc. should be used to create subject projects and build subject portfolios).* *E.g. A project on how children learn using the Piagetian stages. (EG, UP)* *A project on investigation of quadratic inequalities (JHS)* *Make reference to assessment in the course manual and NTEAP* 3.7 Ask each tutor to develop a sample of assessment item based on the LOs and share with the whole group. *Example: Early, Upper Primary and JHS (Core) Grades – Interview 5 basic school teachers during the STS activity on which theory*	3.6 Using discussion, lead tutors to come out with assessment strategies ('as' and 'for') to be used during teaching of the lesson. *NB: Continuous assessment activities (assignments, quizzes, group presentations, etc. should be used to create subject projects and build subject portfolios).* *E.g. A project on how children learn using the Piagetian stages. (EG, UP)* *Make reference to assessment in the course manual and NTEAP* 3.7 Develop a sample of assessment items based on the LOs and share with the whole group. *Example: Early, Upper Primary and JHS (Core) Grades – Interview 10 basic school teachers during the STS activity on mathematics*	

	support their philosophy of teaching. *JHS Grade – In groups of four, draw three different quadratic graphs and write a report on the difference and similarities in the graphs.* 3.8 Lead tutors to discuss the various ways they can support student teachers to build their subject portfolio. *E.g. Encouraging student teachers to i) file all their assignments with feedback in their folders.* *ii)* 3.9 Ask a tutor to model a presentation of an activity using projector, internet search and ensuring both gender take leading roles in the groups. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	*that basic school learners are exposed to a) at home & b) during play* 3.8 Discuss the various ways you can support student teachers to build their subject portfolio. *E.g. Encouraging student teachers to file all their assignments with feedback in their folders and to take notes in class and filing them* 3.9 Prepare and model a presentation of an activity using projector, internet search and ensuring both gender take leading roles in the groups. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	
4. Evaluation and review of session: • Tutors should Identifying critical friends to observe lessons and report at next session • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Evaluation and review of session** 4.1 Engage tutors in providing feedback of the PD session taking into consideration – Clarity of content, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi) and make notes that will help them to teach Lesson 5	**Evaluation and review of session** 4.1 Reflect and provide feedback on this PD session taking into consideration – Clarity of content, pedagogical approaches employed, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi)? and make notes that will help you to teach Lesson 5	**15 mins**

	4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification. ***NB:*** *Take note of all unresolved issues that may need further research or consultation and use any of following strategies to address them.* *i. put on SL/SWL WhatsApp/ Telegram platform for discussion* *ii. tutors to research for the next PD session for discussion* 4.3 Ask tutors to identify a critical friend from the same or related discipline to observe the enactment of their lesson and provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Ask tutors to remember to prepare proforma for Lesson 5 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 6 of the Course Manual on: <u>Early Grade</u> – Major theories of learning and teaching of Early Grade mathematics in inclusive classrooms 2 <u>Upper Primary</u> - Major theories of learning and teaching of Upper primary	4.2 Identify unresolved issues relating to this lesson for clarification. ***NB:*** *Put your unresolved issues unto* the department's *WhatsApp/ Telegram platform and research into the issues raised.* 4.3 Identify a critical friend from the same or related discipline to observe the enactment of your lesson and to provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Remember to prepare proforma for the lesson 5 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 6 of the Course Manual on: <u>Early Grade</u> – Major theories of learning and teaching of Early Grade mathematics in inclusive classrooms 2 <u>Upper Primary</u> - Major theories of learning and teaching of Upper primary mathematics in inclusive	

	mathematics in inclusive classrooms JHS(Core) - Major theories of learning and teaching of Junior High School mathematics in inclusive classrooms 2 JHS (Elective.) – Polynomials: Learning, teaching and applying NB: *i. Read the course manual and the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.* *ii. Collect all-inclusive resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLMs you may need and rehearse how these may be used to support the achievement of your goals*	classrooms JHS (Core) - Major theories of learning and teaching of Junior High School mathematics in inclusive classrooms 2 JHS (Elective) – Polynomials: Learning, teaching and applying NB: *Take note of the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.*	

Age Levels/s:	Name of Subject/s:
a. Early Grade	a. Theories in the Learning of Numeracy in Early Grade
b. Upper Grade	b. Theories in Learning upper primary mathematics
c. JHS (Core)	c. Theories in Learning of Jnr High School Math.
d. JHS (Elective)	d. Further Algebra

Tutor PD Session for Lesson 6 in the Course Manual

Lesson Tittle:

a. Early Grade - Major theories of learning and teaching of Early Grade Mathematics in inclusive classrooms 2.

b. Upper Grade -Major theories of learning and teaching of Upper Primary Mathematics in inclusive classrooms 2.

c. JHS (Core)- Major theories of learning and teaching of Junior High School Mathematics in inclusive classrooms 2.

d. JHS (Elective) – Polynomials: Learning, Teaching and Applying

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in Session**
1. Introduction to the session • Review prior learning • A critical friend to share findings for a short discussion and lessons learned • Reading and discussion of the introductory sections of the	**Introduction** 1.1. Icebreaker activity: Begin with an investigational activity such as a riddle. eg. I am a number; my numerator is the square of the even-prime number and my denominator is half the 2nd power of ten. Who am I?	**Introduction** 1.1. I am a number; my numerator is the square of the even-prime number and my denominator is half the 2nd power of ten. Who am I?	**20mins**

<table>
<tr>
<td>lesson up to and including learning outcomes and indicators
• Overview of content and identification of any distinctive aspects of the lesson/s,
NB The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson.
NB SL/HoD should ask tutors to plan for their teaching as they go through the PD session</td>
<td>1.2. Ask tutors to tell in their phase group how useful the previous PD session was and how it influenced their teaching and learning.

1.3. Ask a critical friend to give feedback on observation during presentation of the fifth lesson.
NB: issues tutor might have observed; tutor's choice of words, pedagogical content knowledge, content knowledge subject matter, ICT tools, GESI and the use of NTEAP

1.4. Ask tutors in their phase group to read and discuss the introductory section of the lesson including the learning outcomes (LOs) in phase groups.

1.5. Ask tutors to identify the purpose of the lesson from the course manual and state their expectations of the PD Session.
<table>
<tr><td colspan="3">PURPOSE OF THE LESSON</td></tr>
<tr><td>Early Grade</td><td>Upper Primary</td><td>JHS(CORE)</td></tr>
<tr><td colspan="3">e.g., to develop student teachers' understanding of nature and importance of</td></tr>
</table>
</td>
<td>1.2. Discuss in your phase group with your friend how useful the previous PD session was and how it influenced your teaching and learning.

1.3. As a critical friend share his/her observation on the fifth lesson. (eg. Teacher's choice of words for delivery, pedagogy used, etc).

1.4. Read and discuss the introductory section of the lesson (up to learning outcomes). Suggest relevant previous knowledge of students that will support effective teaching and learning of the lesson.
1.5. Identify the purpose of the lesson from the course manual and state your expectations of the PD Session.</td>
<td></td>
</tr>
</table>

	Mathematics, understanding of theories of learning e.g., cognitive, constructivist and behaviourist perspectives and their implications for practice. JHS (PECIALISM) e.g., *to develop student teachers' conceptual knowledge in order to prepare them well enough to be able to handle concepts in indices and logarithms as required by the JHS curriculum.* *NB: Discuss children development of Mathematics across the developmental levels, identify some psychological factors influencing teaching and develop pedagogical approach to teach and address misconception of polynomial functions.* 1.6. Ask tutors in their phase groups to discuss the important or distinctive aspects of the third lesson including vocabulary and concepts fundamental. *i. Major theories of learning and teaching across the Grades Mathematics (Early Grade, Upper Grade, JHS-core) in inclusive classrooms 2.* *ii. JHS (Specialism) Learning, teaching and applying Polynomial Functions.*	1.6 In your phase groups, discuss the distinctive aspects of the sixth lesson including vocabulary and fundamental concepts.	

	Distinctive aspects include the interactive nature of the activities, emphasis on connecting concepts: a. Early, Upper Prim & JHS (Core) Grade: – eg. A cognitive perspective, constructivism, behaviourism and Implications for practice. b. JHS; Further Algebra – eg. Misconceptions, barriers, Meaning of polynomials functions and factorization of polynomials; types of polynomials; the Remainder and Factor theorems and applications of polynomial functions; N/B Likely question from tutors to be addressed (Anticipated questions): *i.* How does a cognitive perspective, constructivism, behaviourism theory of learning connect to influence effective teaching of mathematics or specific topic? *ii.* What ways can unfactorized polynomials be explored?		
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new learning, potential barriers to learning for student teachers	2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group. *Familiar Concept: factorization, remainder theorem, stages of learning, non-negative*	2.1 Identify familiar and unfamiliar concepts in their lessons and discuss with the larger group.	40 mins

or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	*integer powers,* *Unfamiliar Concept: zero as a polynomial, many variables in polynomials* 2.2 Lead tutors to draw connections among concepts in the various lessons in line with the Basic School Curriculum. ***NB:*** *distributing property in Integer, etc* 2.3 Ask tutors to outline possible challenging areas in: (e) Teacher's alignment of theories in Mathematics with current basic school mathematics curriculum and classroom inclusion practice. (f) Learning, teaching and applying polynomials functions: Taking GESI consideration (eg. Teacher makes sure learning styles of students inculcate in the teaching of the lesson) 2.4 Lead tutors in their phase group to discuss misconceptions and barriers in teaching and learning of the lesson. Example: Mathematics is not learnt but born with JHS(Specialism) Polynomial functions: Learning, teaching and applying	2.2 Draw connections among concepts in the various lessons in line with the basic school curriculum. 2.3 Outline possible challenging areas in Teaching of theories in Mathematics with current basic school mathematics curriculum and classroom inclusion practice and Learning, teaching and applying polynomials functions: taking into consideration GESI. (eg teacher makes sure to factor students learning and teaching styles in the teaching of the lesson and differentiated approach) 2.4 Participate actively in the discussion of misconceptions and barriers in teaching and learning of the lesson.	

	Example: The challenge involves considering zero as a polynomial. *NB: Guide teachers to know the challenge involve in identifying pattern of some numbers.* 2.5 Support tutors to identify GESI responsive resources such as supporting staff with experts in sign language as well as resources such as teacher and learner resource packs, textbooks, course manual, recorded video, Globe, mathematical set, manila cards, permanent markers, graph sheet, etc (NTS 3j, PD Manual pp.21)	2.5 Identify as many GESI responsive resources such as supporting staff with experts in sign language as well as resources such as teacher and learner resource packs, textbooks, course manual, recorded video, Globe, mathematical set, manila cards, permanent markers, oranges and a knife. (NTS 3j, PD Manual pp.21)	
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities for the lesson taking into account GESI (involving everybody, female take leading role presentation in their discussion group) issues. Example: i. Provision made for physically challenged ii. Both genders take leading roles in group task iii. Even distribution of questions to different	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into consideration GESI	

• Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which	categories of learners based on gender, ability, previous experience, etc NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Let tutors read the activities outlined in their course manuals and identify areas that require clarification. *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.* 3.3 Lead tutors to brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. eg. (a)Early Grade, Upper primary and JHS (Core) **Strategy: Expository and Discussion** **Core Competencies:** Problem solving, critical and creative thinking and communication (b) JHS Elective **Strategy:** Use interactive and Collaborative group work (with the aid of ICT tools and other manipulatives to explore the remainder factor theorem and model area of entire rectangle. **Core Competencies**: Critical thinking skills and Collaborative learning 3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the	3.2 Read the activities outlined in your course manual and identify areas that require clarification. 3.3 Brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. 3.4 Discuss the assessment strategies to be used during teaching of the	

need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	lessons (Teaching of theories of learning and teaching of Mathematics in across the grade and inclusive classrooms (EG, UP, JHS) and Learning, teaching and applying polynomial function-JHS Specialism) – 'Assessment as' (NTS 3k). *Assessment must be aligned to the NTEAP and required course. Continuous assessment activities (assignments, quizzes, group presentations, etc, should be used to create subject projects and build subject portfolios*	lesson – 'Assessment as' (NTS 3k).	
	3.5 Lead tutors to discuss the various ways they can support student teachers to build their subject project and subject portfolio.	3.5 Discuss the various ways they can support student teachers to build their subject project and subject portfolios	
	3.6 Let a tutor model a presentation of an activity using ICT tools and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups and in the demonstration of the use of ICT tools) to teach their lessons EG, UP JHS(Core)- similarities and differences among theories in Mathematics and how these impact teaching and learning JHS (SP)- Arithmetic operations on polynomial	3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons **(**NTS 1a, b, 2b, e, 3b, c, J; BSC pp. 23)	

	functions. *Example*: $divide\ \ x^3 + 4x^2 - 7x - 10\ by\ x + 1$. (NTS 1a, b, 2b, e, 3b, c, J; BSC pp. 23 PD manual 21) NB: *Guide tutors to use the internet to s*earch various *expression of polynomial function and application and how various theorist of Mathematics is applied*.		
4. Evaluation and review of session: • Tutors should Identifying critical friends to observe lessons and report at next session. • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Evaluation and review of session:** 4.1 Engage tutors in providing feedback of the PD session taking into consideration – Clarity of concepts, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi) and make notes that will help them to teach Lesson 1 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification. ***N/B:*** *Take note of all unresolved issues that may need further research or consultation and use any of following strategies to address them.* *i. put on SL/SWL WhatsApp platform for discussion* *ii. tutors to research for the next PD session for discussion*	**Evaluation and review of session:** 4.1 Reflect and provide feedback on this PD session taking into consideration – Clarity of concepts, pedagogical approaches employed, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi)? and make notes that will help you to teach Lesson 1 4.2 Identify unresolved issues relating to this lesson for clarification. N/B: *Put your unresolved issues unto* the department's *WhatsApp/ Telegram platform and research into the issues raised.*	**20 mins**

	4.3 Ask tutors to identify a critical friend from the same or related discipline to observe the enactment of their lesson and provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Ask tutors to remember to prepare proforma for Lesson 7 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 7 of the Course Manual on: <u>EG, UP and JHS (Core)</u> – Teacher understanding of theorist in mathematics and their relation to teaching. <u>JHS(Elective)</u> – Polynomial functions; learning, teaching and applying. N/B *i. Read the course manual and the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.* *ii. Collect all-inclusive resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLMs you may need and rehearse how these may be used to support the achievement of your goals*	4.3 Identify a critical friend from the same or related discipline to observe the enactment of your lesson and to provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Remember to prepare proforma for the Lesson 7 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 7 of the Course Manual on: <u>EG, UP and JHS (Core)</u> – Teacher understanding of theorist in mathematics and their relation to teaching. <u>JHS(Elective)</u> – Polynomial functions; learning, teaching and applying. N/B *i. Take note of the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.*	

Age Levels/s:

a. Early Grade
b. Upper Grade
c. JHS (Core)
d. JHS (Elective)

Name of Subject/s:

a. Theories in the Learning of Numeracy in Early Grade
b. Theories in Learning upper primary mathematics
c. Theories in Learning of Jnr High School Math.
d. Further Algebra

Tutor PD Session for Lesson 7 in the Course Manual

Lesson Title:

a. Early Grade- Children and Mathematics
b. Upper Grade- Children and Mathematics
c. JHS (**Core)-** Children and Mathematics
d. JHS(**Specialism**) - Indices and Logarithm: *Learning, teaching and applying*

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1. Introduction to the session • Review prior learning • Reading and discussion of the introductory sections of the lesson up to and including learning outcomes and indicators • Overview of content	1.1 Icebreaker activity: Begin with an investigational activity according to the subjects and age phases. Eg i. A riddle to identify pattern(s) in the list 1,3,5,7,14, 15,17,19, 21, 42, 43,,…. ii. Construct a table of powers of the numbers	1.1 Ice breaker activity: Begin with an investigational activity according to the subjects and age phases Eg. i. A riddle to identify pattern(s) in the list 1,3,5,7,14, 15,17,19, 21, 42, 43,…. ii. Construct a table of powers of the	**20 mins**

and identification of any distinctive aspects of the lesson/s, NB The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson. NB SL/HoD should ask tutors to plan for their teaching as they go through the PD session	with base 10 (ie 10, 100, 1000, 10000, ….. etc) the log of base 10 and compare both results. 1.2 Ask tutors to tell how useful the previous PD session was and how it influenced their teaching in lesson 6. 1.3 Expose tutors to the overview of the subject age phases to be covered in this PD session and how it will be organised. ***i. Early and upper grade and JHS (Core)*** *lessons focus on children's developmental levels, how children learn mathematics and associated theories, and other psychological factors influencing learning* ***ii. JHS (Maths Specialism)*** *lesson seeks to develop student teachers' conceptual understanding of indices and logarithms and how these concepts can be applied in other areas, as well as, plan micro lessons based on related concepts in the JHS mathematics curriculum* 1.4 Ask a critical friend to give feedback on	numbers (ie 10, 100, 1000, 10000, ….. etc) using base 10 and the logarithm of base 10 and compare both results. 1.2 Discuss how useful the previous PD session influenced their teaching over the week. 1.3 Participate in the discussion on the overview of the subject age phases to be covered in this PD session and how it will be organised. 1.4 Participate in the critiquing of the	

	observation during the enactment of lesson 6. 1.5 Ask tutors to suggest the purpose of the lesson and state their expectations of the PD Session. 1.6 Guide tutors to establish the linkage between CLOs and the LOs of the lesson for each of the Phases 1.7 Ask tutors in phase groups to discuss the important or distinctive aspects of the lesson including vocabulary and fundamental concepts. ***Distinctive aspects*** *includes the interactive nature of the activities, emphasis on connecting concepts:* *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *– eg. Investigation on theories and theoretical principles that are relevant to the learning and teaching of mathematics* *b.* ***JHS (Further Algebra):*** *– eg. The exploration of different ways of understanding of relevant theories and principles of learning and their implications for teaching indices and*	feedback on observation during the enactment of lesson 6. 1.5 Engage tutors to suggest the purpose of the lesson and state your expectations of the PD Session. 1.6 Participate in the linkage of the CLOs and the LOs of the lesson for each of the phases 1.7 In pairs discuss the distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters.	

	logarithm *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *iii. Is it not enough for students to mentally count and readily identify them?* *iv. Why do we have to worry students with logarithm with different bases in mathematics?* *N/B: Guide tutors to discuss the possible answers to the anticipated questions, bearing in mind pedagogy, GESI, ICT – E.g. the most appropriate methods depend on age and previous knowledge of learners, objective of lesson.*		
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do	**Concept Development (New learning likely to arise in lesson/s)** 2.1 Ask tutors to identify familiar and unfamiliar concepts in the lesson and discuss with the larger group 2.2 Lead tutors to draw connections among concepts in the various lessons in line with the basic school curriculum Example: ***Early, Upper Prim & JHS (Core) Grade: -***	**Concept Development (New learning likely to arise in lesson/s)** 2.1 Participate in the identification of familiar and unfamiliar concepts in the lesson and discuss with the larger group. 2.2 Draw connections among concepts in the various lessons in line with the basic school curriculum. Example: ***Early, Upper Prim & JHS (Core) Grade: -***	**15 mins**

to introduce and explain the issues/s with tutors	Connecting logical and psychological approaches to learning mathematics in Understanding size, shape and patterns; Ability to count verbally; Recognizing numerals; Understanding one-to-one correspondence **(PD Theme 3)** ***JHS (Further Algebra):*** *–* *establish* and analyse the relationship between the concepts; logarithm and indices and how this can be used to plan a micro lesson based on similar concepts 2.3 Ask tutors to use Think-Pair-Share to outline possible challenging areas in teaching and assessing of; *a.* ***Early, Upper Prim & JHS (Core) Grade:*** – Theoretical principles that explains children's learning of mathematics *b.* ***JHS (Further Algebra)*** Understanding the notation that the inverse exponent function $y = a^x$ is $y = \log_a x$. **N/B** Eg. *The use of differentiated instruction to cater for the needs of all children in the early and upper grade and JHS classrooms, including*	Connecting logical and psychological approaches to learning mathematics in Understanding size, shape and patterns; Ability to count verbally; Recognizing numerals; Understanding one-to-one correspondence **(PD Theme 3)** ***JHS (Further Algebra):*** *–* *establish* and analyse the relationship between the concepts; logarithm and indices and how this can be used to plan a micro lesson based on similar concepts 2.3 Individually, outline the challenging areas in your lesson, share with a member of the same phase group and then with the whole group. *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *–* Theoretical principles that explains children's learning of mathematics. *b.* ***JHS (Further Algebra)*** Understanding the notation that the inverse exponent function $y = a^x$ is $y = \log_a x$.	

	those with special educational needs (SEN) and creating a safe, secure, happy and stimulating learning environment (NTS 3c 3f, pg. 14). 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson Example: <u>Misconceptions</u> a. ***Early, Upper Prim & JHS (Core) Grade:*** – Some mathematics topics are not related to real life b. **JHS (Sp)** : Students inappropriate use of factoring common factors in an algebraic expression to log12-log3+log2 as log(12-3+2) (not understanding concepts of properties of logarithm) <u>Barriers</u> may include weak prior knowledge, lack of appropriate resources, lack of opportunity to use ICT due to failure of electric power (lights-out), bad/weak network, unavailability of internet bundle for students, inadequate contact time due to staff meetings, Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about the lesson	2.4 Participate in the discussion on misconceptions and barriers in teaching and learning of the lesson	

3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action	**Planning for teaching, learning and assessment activities for the lesson/s** 3.1 In their phase groups, ask tutors to suggest teaching and learning activities for the lesson. i. Provision is made for physically challenged persons and persons with other forms of disability ii. Both genders take leading roles in group task iii. Even distribution of questions to different categories of learners based on gender, ability, previous experience, etc. referring to NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Ask tutors to go through the lesson in the course manual and identify areas that require clarification. *Eg.* *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.* 3.3 Ask tutors to brainstorm and explain how a. theoretical perspectives and principles of learning are relevant to children's learning b. relating real life problem to indices and logarithm can improve on the learners understanding of the lesson. Refer to Basic School Curriculum (BSC pp. xv – xvii)	**Planning for teaching, learning and assessment activities for the lesson/s** 3.1 Suggest teaching and learning activities for the lesson. 3.2 Read the activities outlined in your course manual and identify areas that require clarification 3.3 Brainstorm and explain how a. theoretical perspectives and principles of learning that are relevant to children's learning b relating real life problem to indices and logarithm, can improve on the learners understanding of the lesson. Refer to Basic School Curriculum (BSC pp. xv – xvii)	

research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	3.4 Lead tutors to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. eg. (a)EG/UP/JHS (core): **Strategy:** Expository, inquiry and Discussion: to explore the effectiveness of children's learning of mathematics through games and understanding size, shape and patterns. **Core Competencies:** problem formulation and identification, Problem solving, critical and creative thinking and communication (b) JHS Specialism **Strategy:** interactive and Collaborative group work (with the aid of ICT tools and other manipulatives to examine exponential and logarithmic functions. **Core Competencies**: Critical thinking skills and Collaborative learning 3.5 Ask tutors to mention some GESI responsive resources that can be used with the suggested approaches and strategies in achieving the LOs. **E.g.** *Resources may include supporting staff with experts in sign language as well as*	3.4 Suggest some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. 3.5 Mention some GESI responsive resources that can be used with the suggested approaches and strategies in achieving the LOs. ***E.g*** *Resources may include supporting staff with experts in sign language*	

	resources such teacher and learner resource packs, textbooks, course manual, prisms, pyramids, projectors, flip charts, sticky notes, braille, tactile materials, audio and audio-visuals that can be used in the teaching and learning of the concepts mentioned above (NTS 3j) 3.6 Ask tutors to identify and discuss Continuous Assessment for the lesson to support student teacher learning (NTS 3k). *N/B:* *Assessment must be aligned to the NTEAP and required course Assessment to include subject project, subject portfolio and end of semester examination* Eg. Example: **Early, Upper Primary and JHS (Core) Grades** – Interview about 8 basic school teachers during the STS activity on mathematics that basic school learners are exposed to a) at home & b) during play **JHS Grade** – In groups of four, develop any game for teaching any concept within your course outline. 3.7 Lead tutors to discuss the various ways they can support student teachers to build their subject portfolio.	*as well as resources such teacher and learner resource packs, textbooks, etc* 3.6 Identify and discuss continues assessment strategies for the lesson to support student teacher learning (NTS 3k). Eg. Example: **Early, Upper Primary and JHS (Core) Grades** – Interview about 8 basic school teachers during the STS activity on mathematics that basic school learners are exposed to a) at home & b) during play **JHS Grade –** In groups of four, develop any game for teaching any concept within your course outline. 3.7 Lead tutors to discuss the various ways they can support student teachers to build their subject portfolio	

	E.g. encouraging student teachers to file all their assignments with feedback in their folders. *Taking notes in class and filing them* 3.8 Ask a tutor to model a presentation of an activity using projector, internet search and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups) NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii	*E.g. encouraging student teachers to file all their assignments with feedback in their folders.* 3.8 Model a presentation of an activity using projector, internet search and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups) NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii	
4. Evaluation and review of session: • Tutors need to identify critical friends to observe lessons and report at next session • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Evaluation and review of session:** 4.1 Engage tutors in providing feedback of the PD session taking into consideration – Clarity of concepts, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi) and make notes that will help them to teach Lesson 7 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification. ***N/B:*** *Take note of all unresolved issues that may need further research or consultation and use any of*	**Evaluation and review of session:** 4.1 Reflect and provide feedback on this PD session taking into consideration – Clarity of concepts, pedagogical approaches employed, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi)? and make notes that will help you to teach Lesson 7 4.2 Identify unresolved issues relating to this lesson for clarification. ***N/B:*** *Put your unresolved issues unto* the department's *WhatsApp/ Telegram platform and*	**15 mins**

	following strategies to address them. *i. put on SL/SWL WhatsApp platform for discussion* *ii. tutors to research for the next PD session for discussion* 4.3 Ask tutors to identify a critical friend from the same or related discipline to observe the enactment of their lesson and provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Ask tutors to remember to prepare proforma for Lesson 8 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 8 of the Course Manual on: <u>Early Grade</u> – Characteristics of children's developmental stages <u>Upper Primary</u> - Characteristics of children's developmental stages <u>JHS(Core)</u> - Characteristics of children's developmental stages <u>JHS(Sp.)</u> – Indices and Logarithm: *Learning, teaching and applying 2* N/B *i. Read the course manual and the PD session guide ahead of time to identify*	*research into the issues raised.* 4.3 Identify a critical friend from the same or related discipline to observe the enactment of your lesson and to provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Remember to prepare proforma for the Lesson 8 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 8 of the Course Manual on: <u>Early Grade</u> – Teacher beliefs about mathematics and their relation to teaching <u>Upper Primary</u> - Characteristics of children's developmental stages <u>JHS(Core)</u> - Characteristics of children's developmental stages <u>JHS(Sp.)</u> – Indices and Logarithm: *Learning, teaching and applying 2*	

	any outstanding issues relating to the lesson for clarification. *ii. Collect needed resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLRs you may need and rehearse how these may be used to support the achievement of your goals*	N/B: *Take note of the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.*	

Age Levels/s:

a. Early Grade
b. Upper Grade
c. JHS (Core)
d. JHS (Elective

Name of Subject/s:

a. Theories in the Learning of Numeracy in Early Grade
b. Theories in Learning upper primary mathematics
c. Theories in Learning of Jnr High School Math.
d. Further Algebra

Tutor PD Session for Lesson 8 in the Course Manual

Lesson Tittle:

a. Characteristics of children's developmental stages
b. Characteristics of children's developmental stages
c. Characteristics of children's developmental stages
d. Indices and Logarithm: Learning, teaching and applying

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1 Introduction to the session • Review prior learning • A critical friend to share findings for a short discussion and lessons learned • Reading and discussion of the introductory sections of the lesson up to and including learning	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity for the lessons. E.g., How will you guide a 12-year-old learner to identify the number of fives (5s) in 12 1.2 Ask tutors to tell how useful the previous semester's PD session was and how it influenced their teaching in year 1 semester 2.	**Introduction** 1.1 Demonstrate with any relevant learning resources to determine the number of fives in 12 1.2 Tell how useful the previous semester's PD session was and how it influenced your teaching in year 1 semester 2	**20 mins**

<table>
<tr>
<td>outcomes and indicators
• Overview of content and identification of any distinctive aspects of the lesson/s,
NB The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson.
NB SL/HoD should ask tutors to plan for their teaching as they go through the PD session</td>
<td>1.3 Ask a critical friend to give a feedback on observation during enactment of the seventh (7th) lesson.

NB: Things tutor might have observed; tutor's choice of words, pedagogical content knowledge, content knowledge subject matter, ICT tools, GESI and the use of NTEAP

1.4 Ask tutors to read and discuss the introductory section of the lesson including the learning outcomes (LOs) in phase groups.

1.5 Ask tutors to identify the purpose of the lesson from the course manual and state their expectations of the PD Session.
<table>
<tr><td colspan="3">PURPOSE OF THE LESSON</td></tr>
<tr><td>Early Grade</td><td>Upper Primary</td><td>JHS (CORE)</td></tr>
<tr><td colspan="3">e.g. To develop student teachers' understanding of characteristics of children's developmental stages and its implication for teaching at the upper primary level</td></tr>
<tr><td colspan="3">JHS (Elective)</td></tr>
<tr><td colspan="3">e.g., to develop student teachers' conceptual</td></tr>
</table>
</td>
<td>1.3 As a critical friend share his/her observation on the first lesson.

1.4 Read and discuss the introductory section of the lesson (up to learning outcomes). Suggest relevant previous knowledge of students that will support effective teaching and learning of the lesson.

1.5 Identify the purpose of the lesson from the course manual and state your expectations of the PD Session.</td>
<td></td>
</tr>
</table>

	knowledge in order to prepare them well enough to be able to handle concepts in indices and logarithms as required by the JHS curriculum 1.6 Ask tutors in phase groups to discuss the important or distinctive aspects of the lesson including vocabulary and fundamental concepts. **Distinct Aspects** a. EG/UP/JHS (core): Characteristics of children's developmental stages b. JHS (Elective) - Indices and Logarithm Learning, Teaching and Applying **Vocabulary** **EG/UP/JHS (core)** Examples; Theories, Cognitive Speech, Emotional, Language and Physical. **JHS (Elective**): Indices, Logarithms, Operations, Equations, Applications Inverse etc**.** **Fundamental Concepts** **EG/UP/JHS (core)** • Meaning of Development • Types of Development • Some Psychologists and their contributions towards teaching and learning of Maths. Examples: 1. Maria Montessori	1.6 In phase groups, discuss the distinctive aspects of the s lesson including vocabulary and fundamental concepts related to the components of the front matters.	

	2. Friedrich Froebel 3. Johann Heinrich **JHS (Elective)** • Operations on indices and logarithms; • Indicial and logarithm equations • Applications of Indices and Logarithms.		
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group. **EG/UP/JHS (core)** **Examples of Familiar Concepts:** Development, types of Development etc. **Unfamiliar concepts:** Theories of Learning **JHS (SP**): **Examples of Familiar Concepts:** Indices, Equations etc. **Unfamiliar concepts:** Radical function 2.2 Lead tutors to draw connections among concepts in the various lessons in line with the Basic School Curriculum. 2.3 Ask tutors to outline possible challenging areas in: i. Characteristics of children's developmental stages ii. Indices and Logarithm:	2.1 Identify familiar and unfamiliar concepts in their lessons and discuss with the larger group. 2.2 Draw connections among concepts in the various lessons in line with the basic school curriculum. 2.3 Outline possible challenging areas in i. Characteristics of Children's Developmenta Stages. ii. Indices and Logarithms;	**15 mins**

	Learning, teaching and applying **Challenges** <u>EG/UP/JHS(Core):</u> • How children learn Maths • How children cognitive development affects their understanding of mathematics JHS S (Elective): • Any number raised to the power zero is 1 • Any number raised to the power a negative number is a quotient *NB* *Tutor makes sure learning styles of students are discussed in relation to the Challenges)* 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. **Misconceptions** Example: a. EG/ UP/JHS (core) – All humans are one b. JHS(Elective) – There is no difference between power of numbers and indices **Barriers** Some possible barriers • Time • Learning Resources • Teacher Competence NB: Guide tutors to discuss	Learning, Teaching and Applying. Taking into consideration GESI. (eg teacher makes sure to factor students learning styles in the teaching of the lesson) 2.4 Participate actively in the discussion on misconceptions and barriers in teaching and learning of the lesson.	

	how learning resource could be barrier to teaching and learning. 2.5 Support tutors to identify GESI responsive resources such as supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet (NTS 3j, PD Manual pp.38)	 2.5 Identify as many GESI responsive resources such as supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet. (NTS 3j, PD Manual pp.38)	
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities for the lesson taking into account GESI issues. eg. i. Provision made for physically challenged ii. Both genders take leading roles in group task iii. Even distribution of questions to different categories of learners based on gender, ability, previous experience, etc NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Let tutors read the activities outlined in their course manuals and	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into consideration GESI 3.2 Read the activities outlined in your course manual and identify	**40 mins**

ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which need to be developed to support learning • Tutors should be expected to have a	identify areas that require clarification. *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.* 3.3 Lead tutors to brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. eg. (a)EG/UP/JHS (core) **Strategy: Expository and Discussion** **Core Competencies:** Problem solving, critical and creative thinking and communication. (b) JHS (Elective) **Strategy:** interactive and Collaborative group work, Discussion **Core Competencies**: Critical thinking skills, Collaborative learning and Problem-Solving Skills. 3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lessons. NB: Assessment must involve; the subject project and Subject Portfolio based on: Teacher beliefs about mathematics and their relation to teaching (EG, UP, JHS (core) and Sequences and Series: Learning,	areas that require clarification. 3.3 Brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. 3.4 Discuss the assessment strategies to be used during teaching of the lesson- Subject Project and Subject Portfolio). Assessment must be aligned with the NTEAP.	

plan for the next lesson for student teachers	teaching and applying (JHS Elective) *Assessment must be aligned to the NTEAP. Continuous assessment activities (assignments, quizzes, group presentations, etc, should be used to create subject projects and build subject portfolios* ***(See, Appendix II)***		
	3.5 Lead tutors to discuss the various ways they can support student teachers to build their project and subject portfolio.	3.5 Discuss the various ways they can support student teachers to build their project and subject portfolios	
	3.6 Let a tutor model a presentation of an activity using ICT tools and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups and in the demonstration of the use of ICT tools) to teach their lessons EG, UP JHS(Core)- similarities and differences among values, attitudes, and beliefs and how these impact learning JHS (Elective)- Finding the sum of the first n terms of arithmetic progression. *Example***:** *The sum of* ***n*** *and* ***(n – 1)*** *terms of an AP is 441 and 356 respectively. If the first term of the AP is 13 and the common difference is equal to the number of terms, find the common*	3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons **(**NTS 1a, b, 2b, e, 3b, c, J; BSC pp. 23)	

	difference of the AP. **(** NTS 1a, b, 2b, e, 3b, c, J; BSC pp. 23 PD manual 21) NB: *Guide tutors to use the internet to find the formula for finding the sum of the first n terms of arithmetic progression*		
4. Evaluation and review of session: • Tutors should Identifying critical friends to observe lessons and report at next session. • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Reflective Activity** 4.1 Engage tutors in self-evaluation as well as encourage tutors to provide feedback of the PD session taking into consideration inclusivity – how to be patient with Stutterers, using tactile and audio devices for visually challenged, paying attention to all courses, etc. Ask tutors to show by fingers/nods their level of satisfaction with the session. (NTS 1a, 3i). 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification *NB:Take note of all unresolved issues and use any of following strategies* *- put on SL/SWL WhatsApp platform for discussion* *-tutors to research for the next PD session for discussion* 4.3 Ask a critical friend to observe your teaching and record his/her findings to be presented	**Reflective Activity** 4.1 Show by fingers/nods of 5 or 3 or 1 as to those who "really got it", "got some of it" or "didn't get it" respectively. Explain if you really got the lesson 4.2 Reflect on the activities in the session and outline unresolved issues relating to the lesson 4.3 Identify critical friend observes teaching and record his/her findings to be presented after	**15 mins**

	after delivery or in the Next PD session. **NB:** *Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a)* **Advance Preparation** 4.4 Ask tutors to read Lesson 9 of the Course Manual on: **Early Grade** – Multiple intelligences **Upper Primary** - Multiple intelligences **JHS(Core) -** Multiple intelligences **JHS(Elective)** – Binomial expansions: Learning, teaching and applying ***NB:*** *I. Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.* *Collect all-inclusive resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLMs you may need and*	delivery or in the Next PD session. **NB:** I*dentify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a)* **Advance Preparation** 4.4 Read Lesson 9 of the Course Manual on: **Early Grade** – Multiple intelligences **Upper Primary** - **-** Multiple intelligences **JHS(Core)- -** Multiple intelligences **JHS(Elective)** – Binomial expansions: Learning, teaching and applying	

Age Levels/s:

a. Early Grade
b. Upper Grade
c. JHS (Core)
d. JHS (Elective)

Name of Subject/s:

a. Theories in the Learning of Numeracy in Early Grade
b. Theories in Learning upper primary mathematics
c. Theories in Learning of Jnr High School Math.
d. Further Algebra

Tutor PD Session for Lesson 9 in the Course Manual

Lesson Tittle:

i. Multiple intelligences
ii. Multiple intelligences

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1. Introduction to the session • Review prior learning • A critical friend to share findings for a short discussion and lessons learned • Reading and discussion of the introductory sections of the lesson up to and including learning outcomes and indicators	**Introduction** 1.1 Ice breaker activity: Begin with mental mathematics games, and activities about knowledge of algebraic expansion and factorisation E.g., How will you guide a 12-year-old learner to identify the number of fives (5s) in 12 1.2 Ask tutors to tell how useful the previous semester's PD session	**Introduction** 1.1 Demonstrate with any relevant learning resources to determine the number of fives in 12. 1.2 Tell how useful the previous semester's PD session was and how it	**20 mins**

<table>
<tr>
<td>

- Overview of content and identification of any distinctive aspects of the lesson/s,

NB The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson.

NB SL/HoD should ask tutors to plan for their teaching as they go through the PD session

</td>
<td>

was and how it influenced their teaching.

1.3 Ask a critical friend to give feedback on observation during enactment of the eighth (8^{th}) lesson.
NB: Thing's tutor might have observed; tutor's choice of words, pedagogical content knowledge, content knowledge subject matter, ICT tools, GESI and the use of NTEAP

1.4 Ask tutors to read and discuss the introductory section of the lesson including the learning outcomes (LOs) in phase groups.

1.5 Ask tutors to identify the purpose of the lesson from the course manual and state their expectations of the PD Session.

<table>
<tr><td colspan="2">PURPOSE OF THE LESSON</td></tr>
<tr><td>EG</td><td>UP</td></tr>
<tr><td colspan="2">To establish and address students learning needs, perceptions and misconceptions in multiple intelligences.</td></tr>
<tr><td colspan="2">JHS (Core)</td></tr>
</table>

</td>
<td>

influenced your teaching.

1.3 As a critical friend share your observation on the eighth lesson.

1.4 Read and discuss the introductory section of the lesson (up to learning outcomes). Suggest relevant previous knowledge of students that will support effective teaching and learning of the lesson.

1.5 Identify the purpose of the lesson from the course manual and state your expectations of the PD Session.

</td>
<td></td>
</tr>
</table>

	To establish how students learn JHS level Mathematics **JHS (Specialism)** To establish students' competence in handling Binomial Theorem and address their learning needs, perceptions, misconceptions and application in binomial theorems. 1.6 Ask tutors in phase groups to discuss the important or distinctive aspects of the lesson including vocabulary and fundamental concepts. **DISTINCT ASPECTS** a. EG/UP: foundations of multiple intelligences theory and personal development and implication in teaching numeracy. b. JHS (Core): logical and psychological approaches to learning mathematics. c. JHS (Sp): binomial expansion, applications of binomial theorem to real life. **VOCABULARY EXAMPLES:** **EG/UP/JHS**: theories, intelligences, multiple, psychology, readiness, and numeracy **JHS (SP**): binomial, expansion, applications binomial etc**.**	1.6 In phase groups, discuss the distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters.	

	<u>Fundamental Concepts</u> • Meaning of multiple intelligence. • Give an exposition on theories that explain how children develop number readiness. • Some Psychologists and their contributions towards teaching and learning of Maths. • Gardner's principle of multiple intelligence. • Expansion binomial		
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group. 2.2 Lead tutors to draw connections among concepts in the various lessons in line with the Basic School Curriculum. 2.3 Ask tutors to outline possible challenging areas in: a. Multiple of Intelligences theory (EG/UP) b. Psychological approaches to learning (JHS-Core) c. Application of binomial (JHS-Specialism)	2.1 Identify familiar and unfamiliar concepts in their lessons and discuss with the larger group. 2.2 Draw connections among concepts in the various lessons in line with the basic school curriculum. 2.3 Outline possible challenging areas in teaching multiple intelligences, children and mathematics, binomial theorem taking into consideration GESI. (eg teacher makes sure to factor students learning styles in the teaching of the lesson)	**15 mins**

	CHALLENGES EG/UP/JHS(Core): • How children learn Mathematics? • How multiple intelligence theory affect teaching? JHS Specialism: • Any number raised to the power zero is 1 • Any number raised to the power a negative number is a quotient. **NB** Tutor makes sure learning styles of students are discussed in relation to the Challenges) 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. **MISCONCEPTIONS** Example: EG/ UP/JHS (core) – All humans are one JHS(Specialism) – do not recognise when the binomial distribution is an appropriate model and when it is not. **BARRIERS** **Some possible barriers** • Time • Learning Resources • Teacher Competence NB: Guide tutors to discuss how learning resource could be barrier to teaching and learning.	2.4 Participate actively in the discussion on misconceptions and barriers in teaching and learning of the lesson	

	2.5 Support tutors to identify GESI responsive resources such as supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, Globe, mathematical set, manila cards, permanent markers, oranges and a knife. (NTS 3j, PD Manual pp.21)	2.5 Identify as many GESI responsive resources such as supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, Globe, mathematical set, manila cards, permanent markers, oranges and a knife. (NTS 3j, PD Manual pp.21)	
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities for the lesson taking into account GESI issues. eg. i. Provision made for physically challenged ii. Both genders take leading roles in group task iii. Even distribution of questions to different categories of learners based on gender, ability, previous experience, etc NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Let tutors read the activities outlined in their course manuals and identify areas that require clarification. *Strategies to clarify the otherwise dark spots may*	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into consideration GESI 3.2 Read the activities outlined in your course manual and identify areas that require clarification.	**40 mins**

assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	*include investigation, internet search, etc.* 3.3 Lead tutors to brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. eg. (a)Early Grade **Strategy: Expository and Discussion** **Core Competencies:** Problem solving, critical and creative thinking and communication (b)Upper primary **Strategy: Strategy: Expository and Discussion** **Core Competencies:** Problem solving, critical, creative thinking and communication (c)JHS (Core) **Strategy: Strategy: Expository and Discussion** **Core Competencies:** Problem solving, critical, creative thinking and communication (d) JHS Specialism **Strategy:** Use interactive and Collaborative group work (with the aid of ICT tools and other manipulatives to explore the binomial expansion. **Core Competencies**: Critical thinking skills and Collaborative learning	3.3 Brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners.	

	3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lessons (Multiple intelligence theory and how student learn and develop numeracy [EG, UP, JHS]) Binomial Theorem: Learning, teaching and applying)-JHS Specialism – 'Assessment as' (NTS 3k). *Assessment must be aligned to the NTEAP and required course. Continuous assessment activities (assignments, quizzes, group presentations, etc, should be used to create subject projects and build subject portfolios*	3.4 Discuss the assessment strategies to be used during teaching of the lesson – 'Assessment as' (NTS 3k, 3e).	
	3.5 Lead tutors to discuss the various ways they can support student teachers to build their project and subject portfolio.	3.5 Discuss the various ways they can support student teachers to build their project and subject portfolios.	
	3.6 Let a tutor model a presentation of an activity using ICT tools and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups and in the demonstration of the use of ICT tools) to teach their lessons EG, UP JHS(Core)- developing multiple	3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons **(**NTS 1a, b, 2b, e, 3b, c, J; BSC pp. 23)	

	intelligence theorem and how it impacts on learning JHS (SP)- expansion of algebraic expression to n-power. *Example*: **expand** **[**$(a+b)+3)]^3$**.** (NTS 1a, b, 2b, e, 3b, c, J; BSC pp. 23 PD manual 21) NB: *Guide tutors to use the internet to find the formular for finding the sum of the first n terms of arithmetic progression*		
4. Evaluation and review of session: • Tutors should Identifying critical friends to observe lessons and report at next session. • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Evaluation and review of session** 4.1 Engage tutors in self-evaluation as well as encourage tutors to provide feedback of the PD session taking into consideration inclusivity – how to be patient with Stammerers, using tactile and audio devices for visually challenged, paying attention to all courses, etc. Ask tutors to show by fingers/nods their level of satisfaction with the session. (NTS 1a, 3i). 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification *Take note of all unresolved issues and*	**Evaluation and review of session** 4.1 Show by fingers/nods of 5 or 3 or 1 as to those who "really got it", "got some of it" or "didn't get it" respectively. Explain if you really got the lesson. 4.2 Reflect on the activities in the session and outline unresolved issues relating to the lesson	**15 mins**

	use any of following strategies *a. put on SL/SWL WhatsApp platform for discussion* *b. tutors to research for the next PD session for discussion* 4.3 Ask a critical friend to observe your teaching and record his/her findings to be presented after delivery or in the Next PD session. **Advance Preparation** 4.4 Ask tutors to read Lesson 10 of the Course Manual on: **Early Grade** – Factors that affect teaching and learning of numeracy in Early Grade. **Upper Primary** - Factors that affect teaching and learning of numeracy in upper primary. **JHS(Core)-** Factors that affect teaching and learning of numeracy in JHS. **JHS(Specialism)** – Simultaneous equations: Learning, teaching and applying. N/B *Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* *Read the course manual, the PD session guide*	4.3 A critical friend observes teaching and record his/her findings to be presented after delivery or in the Next PD session. **Advance Preparation** 4.4 Read Lesson 10 of the Course Manual on: **Early Grade** – Factors that affect teaching and learning of numeracy in upper primary: **Upper Primary** - Factors that affect teaching and learning of numeracy in Early Grade. **JHS(Core)-** Factors that affect teaching and learning of numeracy in JHS. **JHS(Specialism)** – Simultaneous equations: Learning, teaching and applying.	

	ahead of time to identify any outstanding issues relating to the lesson for clarification. *Collect all-inclusive resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLRs you may need and used*		

i. Children and Mathematics
ii. Binomial expansions: *Learning, teaching and applying*

Age Levels/s:

a. Early Grade
b. Upper Grade
c. JHS (Core)
d. JHS (Elective)

Name of Subject/s:

a. Theories in the Learning of Numeracy in Early Grade
b. Theories in Learning upper primary mathematics
c. Theories in Learning of Jnr High School Math.
d. Further Algebra

Tutor PD Session for Lesson 10 in the Course Manual

Lesson Title:

a. Early Grade- Factors that affect teaching and learning of numeracy in Early Grade
b. Upper Grade- Factors that affect teaching and learning of numeracy in Upper Grade
c. JHS (**Core)-** Factors that affect teaching and learning of numeracy in JHS
d. JHS (**Specialism**) - Simultaneous equations: *Learning, teaching and applying*

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1. Introduction to the session • Review prior learning • Reading and discussion of the introductory sections of the lesson up to and including learning outcomes and indicators • Overview of	1.1 Icebreaker activity: Begin with an investigational activity according to the subjects and age phases. Eg There are two positive numbers whose sum is 11 and their product is 28. What are the numbers? 1.2 Ask tutors to tell how useful the previous PD	1.1 Ice breaker activity: Begin with an investigational activity according to the subjects and age phases Eg. There are two positive numbers whose sum is 11 and their product is 28. What are the numbers 1.2 Discuss how useful the previous PD session	**20 mins**

content and identification of any distinctive aspects of the lesson/s, NB The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson. NB SL/HoD should ask tutors to plan for their teaching as they go through the PD session	session was and how it influenced their teaching in lesson 9. 1.3 Expose tutors to the overview of the subject age phases to be covered in this PD session and how it will be organised. ***Early and upper grade and JHS (Core)*** *lessons focus on developing an understanding of factors that affect children's learning of numeracy and how these can inform their teaching practice* ***JHS (Maths Specialism)*** *lesson seeks to develop student teachers' understanding and conceptual knowledge of simultaneous equation and how to apply the knowledge and understanding in other areas of mathematics and beyond.* 1.4 Ask a critical friend to give feedback on observation during the enactment of lesson 9. 1.5 Ask tutors to suggest the purpose of the lesson and state their expectations of the PD Session. 1.6 Guide tutors to establish the linkage	influenced their teaching over the week. 1.3 Participate in the discussion on the overview of the subject age phases to be covered in this PD session and how it will be organised. 1.4 Participate in the critiquing of the feedback on observation during the enactment of lesson 9. 1.5 Engage tutors to suggest the purpose of the lesson and state your expectations of the PD Session. 1.6 Participate in the linkage of the CLOs and	

	between CLOs and the LOs of the lesson for each of the Phases 1.7 Ask tutors in phase groups to discuss the important or distinctive aspects of the lesson including vocabulary and fundamental concepts. ***Distinctive aspects*** *includes the interactive nature of the activities, emphasis on connecting concepts:* *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *– eg. The exploration on implications of multiple intelligences on teaching and students' learning of numeracy.* *b.* ***JHS (Further Algebra):*** *– eg. To explore the conceptual understanding of the nature of simultaneous equation and its application to real life problems* *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *a. How does maturation and principle of multiple intelligence affect the learning of numeracy?* *b. Do we have Simultaneous inequalities?* *N/B: Guide tutors to discuss the possible answers to the anticipated questions, bearing in mind pedagogy,*	the LOs of the lesson for each of the phases 1.7 In pairs discuss the distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters.	

	GESI, ICT – E.g. the most appropriate methods depend on age and previous knowledge of learners, objective of lesson.		
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	**Concept Development (New learning likely to arise in lesson/s)** 2.1 Ask tutors to identify familiar and unfamiliar concepts in the lesson and discuss with the larger group 2.2 Lead tutors to draw connections among concepts in the various lessons in line with the basic school curriculum Example: ***Early, Upper Prim & JHS (Core) Grade:-*** Connecting implications of multiple intelligences on teaching and students' learning of numeracy **(PD Theme 3)** ***JHS (Further Algebra):*** – connecting the concept of linear graphs and points of intersection in solving simultaneous equations 2.3 Ask tutors to use Think-Pair-Share to outline possible challenging areas in teaching and assessing of; *a.* ***Early, Upper Prim & JHS (Core) Grade:*** – Theoretical principles and factors that	**Concept Development (New learning likely to arise in lesson/s)** 2.1 Participate in the identification of familiar and unfamiliar concepts in the lesson and discuss with the larger group. 2.2 Draw connections among concepts in the various lessons in line with the basic school curriculum. Example: ***Early, Upper Prim & JHS (Core) Grade:-*** Connecting implications of multiple intelligences on teaching and students' learning of numeracy **(PD Theme 3)** ***JHS (Further Algebra):*** – connecting the concept of linear graphs and points of intersection in solving simultaneous equations 2.3 Individually, outline the challenging areas in your lesson, share with a member of the same phase group and then with the whole group. *a.* ***Early, Upper Prim & JHS (Core) Grade:*** – Theoretical principles and factors that	**15 mins**

	explains children's learning of numeracy *b.* ***JHS (Further Algebra)*** in appropriate substitution of an expression of one variable obtained from one to the other **N/B** Eg. *The use of differentiated instruction to cater for the needs of all children in the early and upper grade and JHS classrooms, including those with special educational needs (SEN) and creating a safe, secure, happy and stimulating learning environment (NTS 3c 3f, pg. 14).* 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson Example: <u>Misconceptions</u> a. ***Early, Upper Prim & JHS (Core) Grade:*** – All mathematics is about numeracy b. **JHS (Sp)**: Simultaneous equation always involves two linear equations <u>Barriers</u> a. ***Early, Upper Prim & JHS (Core) Grade:*** – may include weak prior knowledge, lack of appropriate resources, lack of opportunity to use ICT due to failure of electric power (lights-out), bad/weak network,	explains children's learning of numeracy *b.* ***JHS (Further Algebra)*** in appropriate substitution of an expression of one variable obtained from one to the other 2.4 Participate in the discussion on misconceptions and barriers in teaching and learning of the lesson	

	unavailability of internet bundle for students, inadequate contact time due to staff meetings, Different entry behaviours, Socio-cultural issues, different learning needs, misconceptions about the lesson.		
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous	**Planning for teaching, learning and assessment activities for the lesson/s** 3.1 In their phase groups, ask tutors to suggest teaching and learning activities for the lesson. i. Provision is made for physically challenged persons and persons with other forms of disability ii. Both genders take leading roles in group task iii. Even distribution of questions to different categories of learners based on gender, ability, previous experience, etc. referring to NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Ask tutors to go through the lesson in the course manual and identify areas that require clarification. *Eg.* *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.* 3.3 Ask tutors to brainstorm and explain how a. the understanding	**Planning for teaching, learning and assessment activities for the lesson/s** 3.1 Suggest teaching and learning activities for the lesson. 3.2 Read the activities outlined in your course manual and identify areas that require clarification 3.3 Brainstorm and explain how a. understanding factors	

assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	factors affecting the learning of numeracy can improve the learning of the lesson b. relating real life problem to simultaneous equations can improve on the learners understanding of the lesson. Refer to Basic School Curriculum (BSC pp. xv – xvii) 3.4 Lead tutors to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. eg. (a)EG/UP/JHS (core): **Strategy:** Expository, inquiry and Discussion: to explore the effectiveness factors affect the teaching and learning numeracy. **Core Competencies:** problem formulation and identification, Problem solving, critical and creative thinking and communication (b) JHS Specialism **Strategy:** interactive and Collaborative group work (with the aid of ICT tools and other manipulatives to examine the solution to simultaneous equations. **Core Competencies**: Critical thinking skills and Collaborative learning	affecting the learning of numeracy can improve the learning of the lesson b. relating real life problem to simultaneous equations can improve on the learners understanding of the lesson. Refer to Basic School Curriculum (BSC pp. xv – xvii) 3.4 Suggest some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners.	

	3.5 Ask tutors to mention some GESI responsive resources that can be used with the suggested approaches and strategies in achieving the LOs. **E.g.** *Resources may include supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, prisms, pyramids, projectors, flip charts, sticky notes, braille, tactile materials, audio and audio-visuals that can be used in the teaching and learning of the concepts mentioned above (NTS 3j)* 3.6 Ask tutors to identify and discuss continuous assessment for the lesson to support student teacher learning (NTS 3k). *N/B:* *Assessment must be aligned to the NTEAP and required course Assessment to include subject project, subject portfolio and end of semester examination* Eg. Example: **Early, Upper Primary and JHS (Core) Grades** – Interview about 8 basic school teachers during the STS activity on mathematics that basic school learners are exposed to a) at home & b) during	3.5 Mention some GESI responsive resources that can be used with the suggested approaches and strategies in achieving the LOs. ***E.g*** *Resources may include supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, etc* 3.6 Identify and discuss continues assessment strategies for the lesson to support student teacher learning (NTS 3k). Eg. Example: **Early, Upper Primary and JHS (Core) Grades** – Interview about 8 basic school teachers during the STS activity on mathematics that basic school learners are exposed to a) at home & b) during	

	play **JHS Grade** – In groups of four, develop any game for teaching any concept within your course outline. 3.7 Lead tutors to discuss the various ways they can support student teachers to build their subject portfolio. *E.g. encouraging student teachers to file all their assignments with feedback in their folders.* *Taking notes in class and filing them* 3.8 Ask a tutor to model a presentation of an activity using projector, internet search and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups) NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii	play **JHS Grade –** In groups of four, develop any game for teaching any concept within your course outline. 3.7 Lead tutors to discuss the various ways they can support student teachers to build their subject portfolio *E.g. encouraging student teachers to file all their assignments with feedback in their folders.* 3.8 Model a presentation of an activity using projector, internet search and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups) NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii	
4. Evaluation and review of session: • Tutors need to identify critical friends to observe lessons and report at next session • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Evaluation and review of session:** 4.1 Engage tutors in providing feedback of the PD session taking into consideration – Clarity of concepts, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi) and make notes that will help them to teach Lesson 7	**Evaluation and review of session:** 4.1 Reflect and provide feedback on this PD session taking into consideration – Clarity of concepts, pedagogical approaches employed, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi)? and make notes that will help you to teach Lesson 7	**15 mins**

	4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification. ***N/B:*** *Take note of all unresolved issues that may need further research or consultation and use any of following strategies to address them.* *i. put on SL/SWL WhatsApp platform for discussion* *ii. tutors to research for the next PD session for discussion* 4.3 Ask tutors to identify a critical friend from the same or related discipline to observe the enactment of their lesson and provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Ask tutors to remember to prepare proforma for Lesson 11 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 11 of the Course Manual on: <u>Early Grade</u> – Factors *that* affect teaching and learning numeracy in Early Grade <u>Upper Primary</u> - Factors *that* affect teaching and learning numeracy in Upper Primary <u>JHS(Core)</u> - Factors *that*	4.2 Identify unresolved issues relating to this lesson for clarification. N/B: *Put your unresolved issues unto* the department's *WhatsApp/ Telegram platform and research into the issues raised.* 4.3 Identify a critical friend from the same or related discipline to observe the enactment of your lesson and to provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Remember to prepare proforma for the Lesson 11 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 11 of the Course Manual on: <u>Early Grade</u> – Factors *that* affect teaching and learning numeracy in Early Grade <u>Upper Primary</u> - Factors *that* affect teaching and learning numeracy in Upper Primary <u>JHS(Core)</u> - Factors *that*	

	affect teaching and learning numeracy in Junior High School JHS(Sp.) – Matrices: *Learning, teaching and applying* N/B *i. Read the course manual and the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.* *ii. Collect needed resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLRs you may need and rehearse how these may be used to support the achievement of your goals*	affect teaching and learning numeracy in Junior High School JHS(Sp.) – Matrices: *Learning, teaching and applying* N/B *i. Take note of the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.*	

Age Levels/s:

a. Early Grade
b. Upper Grade
c. JHS (Core)
d. JHS (Elective)

Name of Subject/s:

a. Theories in the Learning of Numeracy in Early Grade
b. Theories in Learning upper primary mathematics
c. Theories in Learning of Jnr High School Math.
d. Further Algebra

Tutor PD Session for Lesson 11 in the course manual

Lesson Tittle:

a. Early Grade - Factors that affect teaching and learning numeracy in Early Grade
b. Upper Grade - Factors that affect teaching and learning numeracy in Upper primary
c. JHS (CORE) - Factors that affect teaching and learning numeracy in Junior High School
d. JHS (Elective) - Matrices: Learning, teaching and applying

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1. Introduction to the session • Review prior learning • A critical friend to share findings for a short discussion and lessons learned • Reading and discussion of the introductory sections of the lesson up to and	**Introduction** 1.1 Ice breaker activity: Ask tutors to share their feelings after a lesson they considered very successful and one which was not and what influenced the successes or failures. 1.2 Ask tutors to tell how useful the lesson 10 PD session was and how it	**Introduction** 1.1 Share your feeling after teaching a lesson you considered very successful and one which was not. Tell what influenced the success and failure of the lesson. 1.2 Tell how useful the previous PD session was and how it influenced	**20 mins**

including learning outcomes and indicators • Overview of content and identification of any distinctive aspects of the lesson/s, NB: The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson. NB: SL/HoD should ask tutors to plan for their teaching as they go through the PD session	influenced their teaching over the week. Lead them to mention how students were well placed to employ the various strategies and skills during the Basic School classroom work including STS Field Experience. N/B: *Draw tutors' attention to all NTS references and salient points necessary for the development of their proforma.* 1.3 Ask the critical friend to give feedback on his/ her observation of the previous enacted lesson laying emphasis on clarity of content, assessment strategies, ICT integration, GESI, Twenty First Century Skills. 1.4 Lead tutors to discuss any challenges that arose during the enactment. Eg. In what ways did explanations obtained by students through internet search complicate understanding of concepts? 1.5 Ask tutors to read individually and discuss in pairs the introductory sections of the lesson up to Learning Outcomes.	your teaching over the week. Explain how students were well placed to employ the strategies and skills during Basic School classroom work including STS Field Experience. N/B: *Pay attention to NTS references and salient points necessary for the development of their proforma.* 1.3 As a critical friend, describe how the previous lesson observed went laying emphasis on clarity of content, assessment strategies, ICT integration, GESI, Twenty First Century Skills. 1.4 Discuss any challenges that arose during the enactment. 1.5 Read individually and discuss the introductory sections of the lesson up to Learning Outcomes.	

	1.6 Lead tutors in pairs to discuss the distinctive aspects of lesson 11 such as fundamental concepts and developing awareness of equity and diversity issues and issues on ICT. ***Distinctive aspects*** *include the interactive nature of the activities, emphasizing on connecting concepts:* *a. Early Grade– eg. Socio-cultural factors and Implications for classroom practice* *b. Upper Grade – eg. Socio-cultural factors and Implications for classroom practice* *c. JHS (Core) – eg. Socio-cultural factors and Implications for classroom practice* *d. JHS (Specialism) – eg. The concept of Matrices, types of matrices; operations and properties of matrices* N/B *Be ready for likely questions from tutors for clarification.* *Guide tutors to discuss the possible responses to the anticipated questions, bearing in mind pedagogy, GESI, ICT.* ***Anticipated questions:*** *i Are the factors mentioned the only ones that affect the teaching and learning of mathematics?* *ii In what ways can*	1.6 In pairs, discuss the distinctive aspects of lesson 11 such as fundamental concepts and developing awareness of equity and diversity issues and issues on ICT. ***Distinctive aspects*** *include the interactive nature of the activities, emphasizing on connecting concepts:* *a. Early Grade– eg. Socio-cultural factors and Implications for classroom practice* *b. Upper Grade – eg. Socio-cultural factors and Implications for classroom practice* *c. JHS (Core) – eg. Socio-cultural factors and Implications for classroom practice* *d. JHS (Specialism) – eg. The concept of Matrices, Types of matrices; Operations and property of matrices*	

	matrices be seen in everyday life? *Eg. Considering the ages of learners sitting in rows and columns.*		
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	**Concept Development** 2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group. 2.2 Lead tutors to draw connections among concepts in the various lessons in line with the basic school curriculum. *Example: Adding and subtracting horizontal and column* 2.3 Ask tutors to use Think-Pair-Share to outline possible challenging areas in teaching and assessing the lesson. *Example:* *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *– Assumptions needed to establish socio-cultural factors affecting teaching and learning mathematics.* *b.* ***JHS (Elective):*** *- Steps in Multiplication of matrices* 2.4 Lead tutors to go through the lesson 11 in the Course manual and discuss	**Concept Development** 2.1 Identify familiar and unfamiliar concepts in your lesson and discuss with the larger group. 2.2 In your phase groups, draw connections among concepts in the lesson and in line with the basic school curriculum. 2.3 Individually, outline the challenging areas in your lesson, share with a member of the same phase group and then with the whole group. 2.4 In whole group, go through the lesson 11 in the Course manual and discuss	**15 mins**

	misconceptions and barriers raised. Let them suggest other possible ones not captured in the manual. *Example:* *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *–* *Some people are born with Mathematics and so they easily understand lessons.* *b.* ***JHS (Elective)*** *– Zero matrices do not have entries in the matrix while unit matrix has only one number written in the matrix.* **Barriers:** *Poor foundational knowledge about matrices, lack of appropriate resources, lack of opportunity to use ICT due to failure of electric power (lights-out), bad/weak network, unavailability of internet bundle for students and emergency academic staff meetings.*	misconceptions and barriers raised. Suggest other possible ones not captured in the manual. *Example:* *a.* ***Early, Upper Prim & JHS (Core) Grade:*** *–* *Some people are born with Mathematics and so they easily understand lessons.* *b.* ***JHS (Elective)*** *– Zero matrices do not have entries in the matrix while unit matrix has only one number written in the matrix.* **Barriers:** *Poor foundational knowledge about matrices, lack of appropriate resources, lack of opportunity to use ICT due to failure of electric power (lights-out), bad/weak network, unavailability of internet bundle for students and emergency academic staff meetings.*	
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas	**Planning for teaching, learning and assessment activities** 3.1 In their phase groups, ask tutors to suggest teaching and learning activities for the lesson taking into consideration; i. Provision is made for	**Planning for teaching, learning and assessment activities** 3.1 In your phase groups, ask tutors to suggest teaching and learning activities for teaching the lesson ensuring; i. Provision is made for	**40 mins**

where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two opportunities to use continuous assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations,	SEN ii. Areas of the lesson that genders can be ensured (such as group task) iii. Even distribution of questions to different categories of learners based on gender, ability, previous experience, etc. referring to NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Ask tutors to read the activities of the lesson outlined in the course manual and identify areas that require clarification on content knowledge, pedagogical knowledge and pedagogical content knowledge. NB: *Refer to <u>https://www.researchgate.net</u>* *For information on socio-cultural factors affecting teaching and learning of mathematics* *<u>https://en.wikipedia.org</u> to clarify the otherwise dark spots in matrices.* 3.3 Lead tutors to brainstorm to come up with some pedagogical approaches and their impact on learning of the concepts taking into consideration inclusivity.	SEN ii. Areas of the lesson that genders can be ensured (such as group task) Refer to NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Read the activities outlined in your course manuals and identify areas that require clarification on content knowledge, pedagogical knowledge and pedagogical content knowledge. NB: *Refer to <u>https://www.researchgate.net</u>* *For information on socio-cultural factors affecting teaching and learning of mathematics* *<u>https://en.wikipedia.org</u> to clarify the otherwise dark spots in matrices.* 3.3 Brainstorm to come up with some pedagogical approaches that can be employed during the lesson and their effectiveness towards learning of the concepts. Mention any GESI issues that need	

TLM or other resources which need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	*Example: i) The use of inquiry to explore Connections between the socio-cultural factors and the implication to teaching and learning of mathematics.* *(ii) The use of differentiation and scaffolding to ensure that no learner is left behind (SBC pp. xv)* *iii) Being patient with stutterers, using tactile or braille for visually challenged, providing peer support for those who might need, while you pay attention to all Phases.* 3.4 Ask tutors to explain some suggested teaching strategies that can help inculcate core competencies in student teachers and for that matter Basic School learners. *eg. Using a)* ***Internet Search*** *to identify the types of matrices –use of* ***ICT Skills*** *b)* ***Exploring*** *other factors other than socio-cultural factors which affect teaching and learning of mathematics –* ***Critical Thinking*** 3.5 Ask tutors to mention some GESI responsive resources that can be used with the suggested approaches	consideration while using those approaches 3.4 Suggest teaching strategies to be used in achieving the LOs of the lesson and explain how they can help inculcate core competencies in student teachers and for that matter Basic School learners. 3.5 Mention some GESI responsive resources that can be used with the suggested approaches and	

	and strategies in achieving the LOs. **E.g.** *Resources may include supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, projectors, flip charts, sticky notes, braille, tactile materials, audio and audio-visuals that can be used in the teaching and learning of the concepts mentioned above (NTS 3j)* 3.6 Using discussion, lead tutors to come out with assessment strategies ('as' and 'for') to be used during teaching of the lesson. *NB: Continuous assessment activities such as assignments, quizzes, group presentations, etc. should be used to create subject projects and build subject portfolios*. *E.g. i) A project on factors affecting 3 known topics in the SBC. (EG, UP, JHS(Core)* *ii) A project on the operations on matrices. (JHS-Elective)*	strategies in achieving the LOs. **E.g.** *Resources may include supporting staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, etc* 3.6 Using discussion, lead tutors to come out with assessment strategies ('as' and 'for') to be used during teaching of the lesson. *NB: Continuous assessment activities such as assignments, quizzes, group presentations, etc. should be used to create subject projects and build subject portfolios*. *E.g. i) A project on how factors affecting 3 known topics in the SBC. (EG, UP, JHS(Core)* *ii) A project on the development of a game for teaching a concept under matrices. (JHS)*	

	Make reference to assessment in the course manual and NTEAP 3.7 Ask each tutor to develop a sample assessment item based on the LOs and share with the whole group. *Example: Early, Upper Primary and JHS (Core) Grades – In groups of 4, interview 5 tutors on factors that affected their interest in mathematics during their Basic School days.* *JHS Grade – In groups of four, develop any game to be used to teach a concept in matrices.* 3.8 Lead tutors to discuss the various ways they can support student teachers to build their subject portfolio. *E.g. Encouraging student teachers to i) file all their assignments with feedback in their folders and to take notes in class and filing them.* 3.9 Ask a tutor to model a presentation of an activity using projector, internet search and ensuring both gender take leading roles in the groups. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	*Make reference to assessment in the course manual and NTEAP* 3.7 Develop a sample assessment items based on the LOs and share with the whole group. *Example: Early, Upper Primary and JHS (Core) Grades – In groups of 4, interview 5 tutors on factors that affected their interest in mathematics during their Basic School days.* *JHS Grade – In groups of four, develop any game to be used to teach a concept in matrices.* 3.8 Discuss the various ways you can support student teachers to build their subject portfolio. *E.g. Encouraging student teachers to file all their assignments with feedback in their folders and to take notes in class and filing them.* 3.9 Prepare and model a presentation of an activity using projector, internet search and ensuring both gender take leading roles in the groups. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	

4. Evaluation and review of session: • Tutors should Identifying critical friends to observe lessons and report at next session • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Evaluation and review of session** 4.1 Engage tutors in providing feedback of the PD session taking into consideration – Clarity of content, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi) and make notes that will help them to teach Lesson 5. 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification. ***NB:*** *Take note of all unresolved issues that may need further research or consultation and use any of following strategies to address them.* *i. put on SL/SWL WhatsApp/ Telegram platform for discussion* *ii. tutors to research for the next PD session for discussion* 4.3 Ask tutors to identify a critical friend from the same or related discipline to observe the enactment of their lesson and provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Ask tutors to remember	**Evaluation and review of session** 4.1 Reflect and provide feedback on this PD session taking into consideration – Clarity of content, pedagogical approaches employed, ICT integration, GESI, Twenty First Century Skills (NTS 1a, 3i, BSC pp. x-xvi)? and make notes that will help you to teach Lesson 5 4.2 Identify unresolved issues relating to this lesson for clarification. NB: *Put your unresolved issues unto* the department's *WhatsApp/ Telegram platform and research into the issues raised.* 4.3 Identify a critical friend from the same or related discipline to observe the enactment of your lesson and to provide feedback during the next PD Session (NTS 1a). **Advance Preparation** 4.4 Remember to prepare	**15 mins**

	to prepare proforma for Lesson 5 taking note of distinctive aspects of the lesson and crosscutting issues and read Lesson 12 of the Course Manual on: <u>Early Grade</u> – Factors that affect learning and teaching of numeracy in Early Grade <u>Upper Primary</u> - Factors that affect learning and teaching of numeracy in Upper primary <u>JHS(Core)</u> - Factors that affect learning and teaching of numeracy in Junior High School <u>JHS (Elective.)</u> – Matrices: Learning, teaching and applying 2 NB: *i. Read the course manual and the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.* *ii. Collect all inclusive resources (such as projector, flip chart and sticky notes) you need ahead of time, prepare samples of TLMs you may need and rehearse how these may be used to support the achievement of your goals*	proforma for the lesson 5 taking note of important or distinctive aspects of the lesson and crosscutting issues and read Lesson 12 of the Course Manual on: <u>Early Grade</u> – Factors that affect learning and teaching of numeracy in Early Grade <u>Upper Primary</u> - Factors that affect learning and teaching of numeracy in Upper primary <u>JHS(Core)</u> - Factors that affect learning and teaching of numeracy in Junior High School <u>JHS (Elective.)</u> – Matrices: Learning, teaching and applying 2 NB: *Take note of the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.*	

Age Levels/s:

a. Early Grade
b. Upper Grade
c. JHS (Core)
d. JHS (Elective)

Name of Subject/s:

a. Theories in the Learning of Numeracy in Early Grade
b. Theories in Learning upper primary mathematics
c. Theories in Learning of Jnr High School Math.
d. Further Algebra

Tutor PD Session for Lesson 12 in the Course Manual

Lesson Tittle:

e. Factors that affect learning and teaching of numeracy in Early Grade
f. Factors that affect learning and teaching of numeracy in Upper primary
g. Factors that affect learning and teaching of numeracy in Junior High School
h. Matrices: Learning, teaching and applying 2

Focus: the bullet points provide the frame for what is to be done in the session. The SWL should use the bullets to guide what they write for the SL/HoD and tutors to do and say during each session. Each bullet needs to be addressed and specific reference should be made to the course manual/s.	**Guidance notes on Leading the session.** *What the SL/HoDs will have to say during each stage of the session*	**Guidance Notes on Tutor Activity during the PD Session.** What PD Session participants (Tutors) will do during each stage of the session.	**Time in session**
1. Introduction to the session • Review prior learning • A critical friend to share findings for a short discussion and lessons learned • Reading and discussion of the introductory sections of the lesson up to and including learning outcomes and indicators	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity for the lessons. E.g., Select all prime numbers from the list of the numbers: 2, 3, 4, 5, 6, 7, 8 and 9. 1.2 Ask tutors to tell how useful the previous semester's PD session was and how it	**Introduction** 1.1 Select all the prime numbers from the following numbers: 2, 3, 4, 5, 6, 7, 8, and 9 1.2 Tell how useful the previous semester's PD session was and how it influenced their	**20 mins**

<table>
<tr>
<td>

- Overview of content and identification of any distinctive aspects of the lesson/s,

NB The guidance for SL/HoD should identify and address any areas where tutors might require clarification on any aspect of the lesson.

NB SL/HoD should ask tutors to plan for their teaching as they go through the PD session

</td>
<td>

influenced their teaching.

1.3 Ask a critical friend to give a feedback on observation during enactment of the seventh (11th) lesson.

NB: Things tutor might have observed; tutor's choice of words, pedagogical content knowledge, content knowledge subject matter, ICT tools, GESI and the use of NTEAP

1.4 Ask tutors to read and discuss the introductory section of the lesson including the learning outcomes (LOs) in phase groups.

1.5 Ask tutors to identify the purpose of the lesson from the course manual and state their expectations of the PD Session.

<table>
<tr><td colspan="3">PURPOSE OF THE LESSON</td></tr>
<tr><td>Early Grade</td><td>Upper Primary</td><td>JHS(CORE)</td></tr>
<tr><td colspan="3">e.g. develop in student teachers an awareness and understanding of how social and emotional intelligence, among other factors,</td></tr>
</table>

</td>
<td>

teaching.

1.3 As a critical friend to share his/her observation on the 11th lesson

NB: Consider *choice of words pedagogical content knowledge, content knowledge subject matter, ICT tools, GESI and the use of NTEAP*

1.4 Read and Discuss the introductory section of the lesson (up to learning outcomes). Suggest relevant previous knowledge of students that will support effective teaching and learning of the lesson.

1.5 Identify the purpose of the lesson from the course manual and state your expectations of the PD Session.

</td>
<td></td>
</tr>
</table>

	like attitudes, beliefs, and anxiety can influence their learning and teaching of mathematics; JHS (Elective) e.g. to develop student teachers' understanding of matrices and apply matrix concepts in other fields of mathematics 1.6 Ask tutors in phase groups to discuss the important or distinctive aspects of the lesson including vocabulary and fundamental concepts. **Distinct Aspects** a. EG/UP/HS (core): Factors that affect teaching and learning numeracy b. JHS (Elective) - Matrices: Learning, teaching and applying 2 **Vocabulary** a. EG/UP/JHS (core) Examples: Intelligence, cooperation **b.** JHS (SP): Transpose, Adjoint, Determinants, inverse and Application. **Fundamental Concepts** EG/UP/JHS (core): • Social and emotional intelligence and	1.6 In phase groups, discuss the distinctive aspects of the s lesson including vocabulary and fundamental concepts related to the components of the front matters.	

	children's learning of mathematics • social qualities to be nurtured in children to promote effective learning of mathematics		
2. Concept Development (New learning likely to arise in lesson/s): • Identification and discussion of new learning, potential barriers to learning for student teachers or students, concepts or pedagogy being introduced in the lesson, which need to be explored with the SL/HoD NB The guidance for SL/HoD should set out what they need to do to introduce and explain the issues/s with tutors	2.1 Ask tutors to identify familiar and unfamiliar concepts in their lessons and discuss with the larger group. 2.2 Lead tutors to draw connections among concepts in the various lessons in line with the Basic School Curriculum. 2.3 Ask tutors to outline possible challenging areas in: (g) Factors that affect learning and teaching of numeracy (h) Matrices: Learning, teaching and applying 2 **<u>CHALLENGES</u>** <u>EG/UP/JHS(Core):</u> • What social qualities are to be nurtured in children to promote effective learning of mathematics in Early Grade classroom? JHS Specialism: • Inverse and applications. *NB: Ensure* that *learning*	2.1 Identify familiar and unfamiliar concepts in your lessons and discuss with the larger group. 2.2 Draw connections among concepts in the various lessons in line with the basic school curriculum. 2.3 Outline possible challenging areas in Factors that affect learning and teaching of numeracy. Matrices: Learning, teaching and applying 2. Take into consideration GESI. (eg teacher makes sure to factor students learning styles in the teaching of the lesson) *NB: Ensure that learning*	**15 mins**

	styles of students are discussed in relation to the Challenges) 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. **<u>MISCONCEPTIONS</u>** Example: a. EG/ UP/JHS (core) – Numbers and Numeral are the same. b. JHS(Elective) – Vectors and Matrices are the same. *NB: Guide tutors to differentiate between numbers and numerals. Also, they should be able to differentiate between representation of vectors and the representation of Matrices.* **<u>BARRIERS</u>** **Some possible barriers** • Time • Learning Resources • Teacher Competence *NB: Guide tutors to discuss how learning resource could be barrier to teaching and learning.* 2.5 Support tutors to identify GESI responsive resources such as supporting	*styles of students are discussed in relation to the Challenges)* 2.4 Participate actively in the discussion on misconceptions and barriers in teaching and learning of the lesson 2.5 Identify as many GESI responsive resources such as supporting staff with experts in sign	

	staff with experts in sign language as well as resources such teacher and learner resource packs, textbooks, course manual, Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet (NTS 3j, PD Manual pp.38)	language as well as resources such teacher and learner resource packs, textbooks, course manual, Posters illustrating people using mathematics in the jobs; video clips downloaded from the internet. (NTS 3j, PD Manual pp.38)	
3. Planning for teaching, learning and assessment activities for the lesson/s • Reading and discussion of the teaching and learning activities • Noting and addressing areas where tutors may require clarification • Noting opportunities for making links to the Basic School Curriculum • Noting opportunities for integrating: GESI responsiveness and ICT and 21st C skills • Reading, discussion, and identification of continuous assessment opportunities in the lesson. Each lesson should include at least two	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities for the lesson taking into account GESI issues. eg. i. Provision made for physically challenged ii. Both genders take leading roles in group task iii. Even distribution of questions to different categories of learners based on gender, ability, previous experience, etc NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Let tutors read the activities outlined in their course manuals and identify areas that require clarification. *Strategies to clarify the otherwise dark*	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into consideration GESI 3.2 Read the activities outlined in your course manual and identify areas that require clarification.	**40 mins**

opportunities to use continuous assessment to support student teacher learning • Resources: ○ links to the existing PD Themes, for example, action research, questioning and to other external reference material: literature, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability ○ guidance on any power point presentations, TLM or other resources which need to be developed to support learning • Tutors should be expected to have a plan for the next lesson for student teachers	*spots may include investigation, internet search, etc.* 3.3 Lead tutors to brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. eg. (a)EG/UP/JHS (core) **Strategy: Expository and Discussion** **Core Competencies:** Problem solving, critical and creative thinking and communication. (b) JHS Specialism **Strategy:** interactive and Collaborative group work, Discussion **Core Competencies**: Critical thinking skills, Collaborative learning and Problem-Solving Skills. 3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lessons. NB: Assessment must involve; the subject project and Subject Portfolio based on: Teacher beliefs about mathematics and their relation to teaching (EG,	3.3 Brainstorm to come up with some pedagogical approaches and their related core competencies likely to be inculcated in students and for that matter Basic School learners. 3.4 Discuss the assessment strategies to be used during teaching of the lesson- Subject Project and Subject Portfolio). Assessment must be aligned with the NTEAP.	

	UP, JHS (core) and Sequences and Series: Learning, teaching and applying (JHS Specialism) *Assessment must be aligned to the NTEAP. Continuous assessment activities (assignments, quizzes, group presentations, etc, should be used to create subject projects and build subject portfolios* ***(See, Appendix II)***		
	3.5 Lead tutors to discuss the various ways they can support student teachers to build their project and subject portfolio.	3.5 Discuss the various ways they can support student teachers to build their project and subject portfolios	
	3.6 Let a tutor model a presentation of an activity using ICT tools and taking into consideration GESI issues (eg. Both gender taking the leading roles in their groups and in the demonstration of the use of ICT tools) to teach their lessons EG, UP JHS(Core)- Social and emotional intelligence and children's learning of mathematics JHS (Elective)- Inverse and applications. *Example***:** *Assign student teachers to explore and use manipulative and ICT tools to find inverses of*	3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons **(**NTS 1a, b, 2b, e, 3b, c, J; PD Manual pp.51)	

	matrices and to solve simultaneous equations. **(NTS** 1a, b, 2b, e, 3b, c, J; PD manual 51) NB: *Guide tutors to use the internet to find the formular for finding the sum of the first n terms of arithmetic progression*		
4. Evaluation and review of session: • Tutors should Identifying critical friends to observe lessons and report at next session. • Identifying and addressing any outstanding issues relating to the lesson/s for clarification	**Reflective Activity** 4.1 Engage tutors in self-evaluation as well as encourage tutors to provide feedback of the PD session taking into consideration inclusivity – how to be patient with Stammerers, using tactile and audio devices for visually challenged, paying attention to all courses, etc. Ask tutors to show by fingers/nods their level of satisfaction with the session. (NTS 1a, 3i). 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification *Take note of all unresolved issues and use any of following strategies* *i. put on SL/SWL WhatsApp platform for discussion* *ii. tutors to research for*	**Reflective Activity** 4.1 Show by fingers/nods of 5 or 3 or 1 as to those who "really got it", "got some of it" or "didn't get it" respectively. Explain if you really got the lesson 4.2 Reflect on the activities in the session and outline unresolved issues relating to the lesson	**15 mins**

	the next PD session for discussion 4.3 Ask a critical friend to observe your teaching and record his/her findings to be presented after delivery or in the Next PD session. **NB:** *Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a)* **Advance Preparation** 4.4 Ask tutors to record their suggestions and recommendations that will inform the next PD Session.	 4.3 Identify critical friend observes teaching and record his/her findings to be presented after delivery or in the Next PD session. **NB:** *to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a)* **Advance Preparation** 4.4 Record and submit your suggestions and recommendations that will inform the next PD Session to the Subject lead	

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 Support Team	
Professor Jophus Anamuah-Mensah	T-TEL – T-TEL Board Chair
Professor Jonathan Fletcher	T-TEL – Key Advisor, Teaching & Learning Partnerships
Bea Noble-Rogers	T-TEL – International Teacher Education Curriculum Expert
Dr. Sam Awuku	T-TEL – Key Advisor, Leadership for Learning & Institutional Development
Dinah Adiko	T-TEL – Key Advisor, Gender Equality and Social Inclusion
Beryl Opong-Agyei	T-TEL – National Coordinator for Teacher Education
Marjorie Tackie	T-TEL – Coordinator for Gender Equality and Social Inclusion
Wellington Mpeniasah	T-TEL – Education Advisor
Victor Sunkwa Asamoah	T-TEL – Education Advisor
Wilhemina Gyamfi	T-TEL – Education Advisor
Issahaku Abudulai	T-TEL – Education Advisor
Roger Kwamina Aikins	GM – Commercial (Oversees design, print and distribution)

Subject Writing Team		
SUBJECT	**NAME**	**INSTITUTION**
French	Felix Asare Odonkor	University of Education, Winneba
	Dr. Stella Afi Makafui Yegblemenawo	Kwame Nkrumah University of Science and Technology, Kumasi
	Osmanu Ibrahim	Mt. Mary College of Education, Somanya
Pedagogy	Dr. Maxwell Kwesi Nyatsikor	University for Development Studies, Tamale
	Dr. Winston Kwame Abroampa	Kwame Nkrumah University of Science and Technology, Kumasi
	Dr. John Sedofia	University of Ghana, Legon Accra
	Kweku Esia-Donkoh	University of Education, Winneba
	Fadilata Seidu	Nusrat Jahan Ahmadiyya College of Education, Wa
	Dr. Yaw Nyadu Offei	University of Education, Winneba
	John Aditorem	Tumu College of Education, Tumu
ICT	Victoria Boafo	Mampong Technical College of Education, Mampong Ashanti
	Paul Mensah	St. Louis College of Education, Kumasi
	Richard Adusei	University for Development Studies, Tamale
Social Sciences	Dr. Aboagye Dacosta	Kwame Nkrumah University of Science and Technology, Kumasi
	Dr. Cletus Ngaaso	University of Education, Winneba
	Limpu Isaac Digbun	Bagabaga College of Education, Tamale
	Felix Dongballe	McCoy College of Education, Nadowli
	Mercy Sarpong Mintah-Botchey	Presbyterian College of Education, Akropong
	Salifu Fawzi Rahaman	Nusrat Jahan Ahmadiyya College of Education, Wa
	Abudulai Ibrahim	Gambaga College of Education, Gambaga
	Joseph Mihaye	Accra College of Education, Accra
	Burukum Achor	Dambai College of Education, Dambai
	Tia Yahaya	Tamale College of Education, Tamale
TVET	Rev. Dr. Nyuieko Avotri	Mampong Technical CoE, Ashanti Mampong
	Rev. Godwin Gbadagba	Dambai College of Education, Dambai
	Grace Annagmeng Mwini	Tumu College of Education, Tumu
	Michael Eco Adixey	Akatsi College of Education, Akatsi
	Rejoice Makafui Tsotorvor	Akatsi College of Education, Akatsi
	David Kodzo Ankutse	Accra College of Education, Accra
PEMD	Justice Gideon Adjerakor	University of Education, Winneba
	Godfred Teye Mensah Akuffo	Bia Lamplighter College of Education, Sefwi Debiso

Science	Prof Reuben Yao Tamakloe	Kwame Nkrumah University of Science and Technology, Kumasi
	Valentina Osei - Himah	Atebubu College of Education, Atebubu
	Comfort Korkor Sam	University for Development Studies, Tamale
	Ambrose Ayikue	St. Francis College of Education, Hohoe
	Maxwell Bunu	Ada College of Education, Ada
Mathematics	Prof Gabriel Asare Okyere	Kwame Nkrumah University of Science and Technology, Kumasi
	Eric Abban	Mt. Mary College of Education, Somanya
	Eric Kwame Austro Gozah	Dambai College of Education, Dambai
	Frank Asah Akuffo	University for Development Studies, Tamale
Language and Literacy	Prof. Charles Owu – Ewie	University of Education, Winneba
	Dr. Abraham Kwadwo Okrah	University of Ghana, Legon Accra
	Dr. Emma Sarah Eshun	University of Education, Winneba
	Abdul-Moomin Abdul-Aziz	Nusrat Jahan Ahmadiyya College of Education, Wa
	Freda Asante Kumi	Accra College of Education, Accra
	Dr Kwesi Adomako	University of Education, Winneba
	Comfort Dorvlo	Accra College of Education, Accra
	Awudu Rafick	University for Development Studies, Tamale
Cross Cutting GESI	Dr Rita Yeboah	University of Ghana, Legon Accra
	Florence Kazi	Bagabaga College of Education, Tamale
	Juliana Dinko	St Joseph's College of Education, Bechem
Cross Cutting ICT	Victor K Anyanful	OLA College of Education, Cape Coast
	Nelson K Soh	Dambai College of Education, Dambai