PROFESSIONAL DEVELOPMENT PROGRAMME

Tutor Professional Development Handbook: B.Ed. in Initial Teacher Education - Mathematics Year 3 Semester 1

HANDBOOK FOR **COORDINATORS**

Wisdom, Knowledge and Prudence

The Government of Ghana

Foreword

In Ghana we have made great strides in transforming our teacher education system over the past few years. With each passing year the changes brought about through these reforms are maturing, embedding, and sustaining. Once the first B.Ed. graduates from Colleges of Education enter basic school classrooms from 2022 onwards, I am sure that as a nation, we will truly start to see the benefits of these reforms.

The success of national reforms depends on individual tutors and individual teachers working in classrooms across the country every day. The progress that we want to see will only be brought about through the consistent and regular application of the professional knowledge, professional practice and professional values and attitudes set out in the National Teachers' Standards.

This is where the Tutor Professional Development Handbooks have such an important role to play, and it is very pleasing to see the continued development and use of these handbooks as we enter the 3rd Year of the B.Ed. in Initial Teacher Education.

These 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. Assessment is one of the areas where we need to pay particular attention as the teacher education reforms matures and is sustained. The National Teacher Education Assessment Policy sets out the range of formative and summative modes and methods of assessment required to ensure that the B.Ed. is both implemented and assessed as planned. Assessment is a key driver of learner behaviour, and we must all ensure that we are familiar with the National Teacher Education Assessment Policy and applying it consistently to ensure that we eliminate the 'chew, pour, pass and forget' syndrome which has infected our education system. These Handbooks pay particular attention to assessment and are an important tool in ensuring that we are all following national policy guidelines correctly and consistently.

This latest set of Professional Development Handbooks, developed by four mentoring universities (University for Development Studies, University of Education, Winneba, University of Ghana and Kwame Nkrumah University of Science and Technology) and tutors from their affiliated Colleges of Education, are the second set of Professional Development Handbooks to be developed since Transforming Teaching, Education & Learning (T-TEL) became a Ghanaian not-for-profit organisation. I would like to take this opportunity to thank both the Ghana Tertiary Education Commission and Mastercard Foundation for making all this possible.

Robin Todd
Executive Director, T-TEL
September 2021

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

- The PD sessions provide opportunities for tutors to work and plan together to make sure the new B.Ed. courses are taught well
- They are an important way to ensure effective implementation of the B.Ed. and the NTEAP, this may require PD writers to add more detail to what is in the course manuals. Specifically, this means a focus on the integration of:
    - GESI to ensure the needs of females, males and students with special education needs are well catered for (also a stand-alone PD session)
    - ICT and 21c skills to ensure students learn to use technology effectively to support their own and pupils' learning (also a stand-alone PD session)
    - NTEAP and the use of continuous assessment to support learning (also a stand-alone PD session)
- The PD session template provides guidance notes for the Subject Leads (SL)/HoD on how to lead the weekly PD sessions in the CoE
- To ensure appropriate subject and age phase focus for the PD sessions, in line with the B.Ed. requirements
    - where subjects are grouped direct reference needs to be made to the course manuals for each subject
    - Where there are different age phases direct reference needs to be made to the course manuals for each age phase
- SL/HoD need to have details of the resources needed for all the activities including guidance on how to create any TLMs and references to literature, previous PD themes etc.
- The PD writing checklist covers the key issues to be addressed in each session. PD writers should use it to support the writing and review of the PD sessions.

Age Phase(s):

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

Name of Subjec(s):

a. Mathematics: Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Teaching and Assessing JHS
d. Mathematics – Calculus

Tutor PD Session for Lesson 1 in the Course Manual

Lesson Tittle:

a. Early Grade - Counting, Patterns and Relationships
b. Upper Grade - Counting, Patterns and Relationships
c. JHS (CORE) - Measurement, Shape and Space
d. JHS (SP) - Limits and Continuity: Learning and applying

Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction / lesson overview • Overview of subject/s age phase/s to be covered in this PD session and how it will be organised. Including guidance on grouping tutors according to the subject/s, age phase/s. • Reflection on previous PD Session (Introduction to the course manual/s) • Introduction and overview of the main purpose of the lesson in the course manual/s	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity on continuing patterns of numbers (e.g. continue: i. $\frac{1}{10}, \frac{1}{100}, \frac{1}{1000}, \frac{1}{10000}, \ldots$ ii. $\frac{3}{10}, \frac{5}{10}, \frac{7}{10}, \frac{9}{10}, \ldots$) 1.2 Ask tutors to discuss the overview of the phases to be covered in this PD session and how it will be organized. *i. Early and upper Grade: The lesson considers counting and representing numbers, number patterns and relationships as well as investigations with numbers. It also considers how the various assessment strategies can be incorporated in the lesson*	**Introduction** 1.1 Continue the patterns with the next term. i. $\frac{1}{10}, \frac{1}{100}, \frac{1}{1000}, \frac{1}{10000}, \ldots$ ii. $\frac{3}{10}, \frac{5}{10}, \frac{7}{10}, \frac{9}{10}, \ldots$) 1.2 Discuss the overview of the phases to be covered in this PD session and how it will be organized. N/B If you teach more than one course, join the course group which you may need support in preparation.	

• Identification of important or distinctive aspects of the lesson/s • Reading and discussion of the introductory sections up to learning outcomes	*as well as in the Basic School classroom.* *ii. JHS Core considers exploring shapes and their properties, relationship among faces, edges and vertices, perimeters, areas of 2-D shapes and properties and volumes of 3-D shapes.* *iii. JHS – Calculus considers relationship between the everyday use of the term 'limit' and how it relates to the definition of limits. It further considers limits of a function and its properties.* ***N/B:*** *I) Remember to put members into groups according to the phases to be taught in the semester.* *II)Tutors who are teaching more than one course should join any course which they may have much challenge. Ask tutors to tell how useful the previous semester's PD session was and how it influenced their teaching in year 2 semester 2.* 1. 1.3 Ask tutors to identify the purpose of the lesson from the course manual and state their expectations of the PD Session. 1.4 Ask tutors to read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate 1.5 Guide tutors to establish the relationship between	*Tell how useful the previous semester's PD session was and how it influenced your teaching in year 2 semester 2.* 1.3 Identify the purpose of the lesson from the course manual and state your expectations of the PD Session. 1.4 Read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate 1.5 Guide tutors to establish the relationship between	

	CLOs and the learning outcomes of individual lessons in the course 1.6 Ask tutors in phase groups discuss the important or distinctive aspects of the first lesson including vocabulary and fundamental concepts related to the components of the front matters. ***Distinctive aspects*** *include the interactive nature of the activities, emphasis on connecting concepts:* *a. Early Grade– eg. relationships between place value, fractions and Patterns.* *b. Upper Grade – eg. relationships between place value, fractions and Patterns.* *c. JHS; Assessment – eg. Linking ICT with literacy and numeracy* *d. JHS; Calculus – eg. application of calculus in real life situations* 1.7 Ask tutors to read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson. N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *i. Why teaching counting at this level?* *ii. Do plane shapes have faces?*	CLOs and the learning outcomes of individual lessons in the course 1.6 In phase groups, discuss the distinctive aspects of the first lesson including vocabulary and fundamental concepts related to the components of the front matters. 1.7 Read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson.	

	iii. What is the relationship between functions and limit?		
The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which might arise from the introduction to the lesson and provide responses for SL/HoD.* • *Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD*			
2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. • Identification of needed resources for the teaching	**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. 2.3 Ask tutors to outline possible challenging areas in Teaching and Assessing,	**Concept Development** 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 and Assessing, measurement of shape	**25 mins**

and learning of the concept.	Measurement of Shape and Space and in Calculus taking into consideration GESI (eg. Avoid making discriminatory statements such as : “even the girls are doing better”) 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. Example: a. Early Grade – one(1) is a prime number b. Upper Grade - one(1) is a prime number c. JHS (CORE) – Plane shapes can be touched d. JHS (Calculus) – Calculus is For boys 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, prisms, pyramids, projectors, flip charts, sticky notes, tactile materials that can be used in the teaching and learning of the concepts mentioned above (NTS 3j)	and space and in calculus taking into consideration GESI. (eg. Avoid making discriminatory statements such as : “even the girls are doing better”) 2.4 Participate 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 language as well as resources such as teacher and learner resource packs, textbooks, course manual, prisms, pyramids, etc that can be used in the teaching and learning of the concepts in Teaching and Assessing, measurement of shape and space and in calculus NTS 3j	
Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of*			

new learning and which needs to be considered prior to taking tutors through the lesson activities " walk through". • *The resources needed must be identified: literature – page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability* • *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification • Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course assessment: subject project (30%), subject portfolio (30%) and end of	**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 Draw tutors attention to' NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Let tutors read the activities outlined in their	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into account GESI issues. 3.2 Read the activities outlined in your course	**40 mins**

<table>
<tr>
<td>semester examination (40%)
• Working through one or two activities,</td>
<td>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.
<table>
<tr><th>Strategy</th><th>Core Competency</th></tr>
<tr><td>Group Work</td><td>Collaborative learning</td></tr>
<tr><td>Investigation</td><td>Critical Thinking</td></tr>
<tr><td>Role Play</td><td>Communication</td></tr>
</table>
3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson – ‘Assessment as’ (Draw tutors attention to NTS 3k).Take a sample of responses
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

3.5 Lead tutors to discuss the various ways they can support student teachers to build their project and subject portfolio for the semester.

3.6 Ask a tutor to model a presentation of an activity</td>
<td>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 lesson – ‘Assessment as’ (take note of NTS 3k).

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

	using ICT tools and taking into consideration GESI issues (eg. Both genders taking the leading roles in their groups and in the demonstration of the use of ICT tools) in the lesson Teaching and Assessing and in Calculus. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	and taking into consideration GESI issues in the lessons; Teaching and Assessing and in Calculus. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	
Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course assessment components* • *The selected activities should be done with tutors in real or close to real time* • *Anticipate any issues for clarification or questions which might arise as the*			

tutors work through the activities and provide guidance on these • *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied* • *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide guidance on development of these*			
4. Evaluation and review of session: • identification of any outstanding issues relating to this lesson 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 –	**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.	**5 mins**

• Advance preparation • In the case of unresolved issues	how to be patient with stutterers, using tactile for visually challenged, paying attention to all courses, etc. Ask tutors to show by fingers/nods their level odf satisfaction with the session. (NTS 1a, 3i). 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification ***N/B:*** *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* **Advance Preparation** Ask tutors to read Lesson 2 of the Course Manual on: **Early Grade** - Place value: (Teaching and Assessing) **Upper Primary** - Counting and Number Relationships **JHS; Teaching and Assessment** - Construction, Angles and Polygons: (Teaching and Assessing 2) **JHS Calculus** - Limits and Continuity: Learning and applying N/B I. *Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).*	4.2 Reflect on the activities in the session and outline unresolved issues relating to the lesson **Advance Preparation** Read Lesson 2 of the Course Manual on: **Early Grade** - Place value: (Teaching and Assessing) **Upper Primary** - Counting and Number Relationships **JHS; Teaching and Assessment** - Construction, Angles and Polygons: (Teaching and Assessing 2) **JHS Calculus** - Limits and Continuity: Learning and applying N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	

	II. *Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.* III. *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*		
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring: subject project, subject portfolio preparation and development are explicitly addressed in the PD sessions.	The session above is exactly what is required. Of particular value is the conclusion and evaluation section. Please apply relevant comments here to the remainder of the lessons.		

Age Phase:

a. Early Grade
b. Upper Grade
c. JHS (CORE)
d. JHS (SP)

Name of Courses:

a. Teaching and Assessing Numeracy
b. Teaching and Assessing mathematics for Upper Primary
c. Teaching and Assessing JHS Mathematics
d. Euclidean Geometry

Tutor PD Session for Lesson 2 in the Course Manual

Lesson Tittle: a. Early Grade - Place value b. Upper Grade - Place value c. JHS (CORE) - Construction, Angles and Polygons d. JHS (SP) - Limits and Continuity: Learning and applying			
Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction / lesson overview • Reflection on previous PD Session (Introduction to the course manual) • Introduction and overview of the main purpose of the lesson in the course manual. • Highlight cross cutting themes i.e., gender equality and social inclusion (GESI), ICT • Identification of important or distinctive aspects of the lesson • Reading and discussion of the	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity (e.g. Play "Tell my digit". Mention a number (say 27,342) and let tutors tell the digit that goes with a particular place mentioned) 1.2 Ask tutors to tell how useful the week one PD session (NTS 1b) influenced their teaching over the week and how students were well placed to employ the various concepts during the Basic School classroom work. 1.3 Ask a critical friend to give feedback on observation during the enactment of lesson 1 on:	**Introduction** 1.1 Engage in an investigational activity (e.g. In 27,342 which digit is at the "thousands" place?) 1.2 Explain how useful the week one PD session influenced your teaching over the week and how students were well placed to employ the various concepts during the Basic School classroom work. 1.3 As a critical friend, share with members feedback on observation during the teaching of:	**15 mins**

introductory sections up to learning outcomes	a. Early Grade - Counting, Patterns and Relationships b. Upper Grade - Counting, Patterns and Relationships c. JHS (CORE) - Measurement, Shape and Space d. JHS (SP) - Limits and Continuity: Learning and applying N/B: Draw tutors' attention to all NTS references.	a. Early Grade - Place value b. Upper Grade - Place value c. JHS (CORE) - Construction, Angles and Polygons d. JHS (SP) - Limits and Continuity: Learning and applying N/B: Take note of all NTS references.	
	1.4 Lead tutors to discuss any challenges that arose during the enactment. Eg In what ways did the students appreciate the need to consider equality and equity during the lesson and during STS activities?	1.4 Discuss any challenges that arose during the enactment. Eg In what ways did the students appreciate the need to consider equality and equity during the lesson and during STS activities?	
	1.5 Ask tutors to read the course manual and identify the purpose and learning outcomes of the lesson for the day. Ask members to state their expectations of the PD Session on lesson2. NTS 2b.	1.5 Read the course manual and identify the purpose of the lesson (NTS 2b) and state your expectations of the PD Session.	
	1.6 Lead tutors to outline the important features of lesson 2 in the course manual taking note of cross cutting themes (including developing awareness of equity and diversity issues and issues on ICT).	1.6 Identify the important features of lesson 2 in the course manual taking note of cross cutting themes (including developing awareness of equity and diversity issues and issues on ICT).	
	1.7 Ask tutors to silently read the introductory sections (up to learning outcomes) and discuss the important	1.7 Read the introductory sections (up to learning outcomes) silently and in pairs/groups discuss the	

	or distinctive aspects of the lesson (i.e. the interactive nature of the activities, emphasis on curriculum, how an understanding of mathematics develops, effective use of constructing geometrical shapes and exploring the meanings of limits and continuity as used in everyday situation and in calculus) Refer to course manual, lesson 2	important or distinctive aspects of the lesson (i.e. the interactive nature of the activities, emphasis on curriculum, how an understanding of mathematics develops, effective use of constructing geometrical shapes and exploring the meanings of limits and continuity as used in everyday situation and in calculus) Refer to course manual, Lesson 2	
The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which might arise from the introduction to the lesson and provide responses for SL/HoD.* • *Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD*			

2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. This may include GESI and ICT related concepts • Identification of needed GESI responsive and ICT resources for the teaching and learning of the concept.	**Concept Development** 2.1 Lead tutors to identify familiar and unfamiliar concepts in the lesson and discuss with the larger group. 2.2 Lead tutors to draw relevant connections among concepts in the lesson with other lessons. Example; i. Dealing with operations on numbers up to 10,000,000. (B.ED course manual and BSC content standard **B3.1.1.1.; B5.1.1.1; B6.1.1.1**) ii. place value (BSC content standard **B4.1.4.1**) iii. Constructing lines and angles iv. Limits and Continuity 2.3 Ask tutors to outline possible challenging areas in teaching and learning i Place value, ii Construction, Angles and Polygons, iii Limits and Continuity as pertain to B.ED class and at the Basic School classroom. Take into consideration GESI related issues (eg. Make provision for tutors as well as students with a challenge of using the hand to explain process instead of to constructing). 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. Example:	**Concept Development** 2.1 Identify familiar and unfamiliar concepts in the lesson and discuss with the larger group. 2.2 Draw relevant connections among concepts in the lesson with other lessons and the use of relevant resources. 2.3 Outline possible challenging areas in teaching and learning Place value, Construction, Angles and Polygons, Limits and Continuity as pertain to B.ED class and at the Basic School classroom. Take into consideration GESI related issues 2.4 Explore potential misconceptions of teaching and learning “place value”, “construction of angles and polygons”, and “limits and continuity”.	**25 mins**

	a. Early Grade – the place of a digit in a numeral is the same as its value. b. Upper Grade – the only way to operate on multi digits is to arrange vertically c. JHS (CORE) – an angle is just a figure(shape) d. JHS (Calculus) – the limit is equal to the function value at a point. ***N/B:*** *Refer tutors to the lesson 2 of the course manual for other potential misconceptions and barriers.* ***Barriers:*** *Non availability of appropriate: inclusive resource, Technology, Pre-requisite knowledge*		
	2.5 Ask tutors to suggest creative approaches for addressing the identified challenges. Eg. Using group work, problem solving, internet search, the principle of multiple embodiment.	2.5 Suggest creative approaches for addressing the identified challenges.	
	2.6 Support tutors to identify GESI responsive resources such as supporting staff for sign language, projectors, flip charts, sticky notes, tactile that can be used in the teaching and learning of the concepts mentioned above. Other materials include curriculum materials (teachers and learners resource packs, textbooks, course manual, prism and pyramids, etc.) Draw tutors attention to NTS 3j	2.6 Identify GESI responsive resources in the environment and at the Basic school that will support achieving the learning outcomes of the lesson.	

Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be considered prior to taking tutors through the lesson activities " walk through".* • *The resources needed must be identified: literature – page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability* • *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification especially GESI related activities. • Reading of teaching and learning activities and identification	**Teaching, learning and assessment activities for the lesson.** 3.1 Ask tutors to suggest teaching and learning activities useful for achieving the learning outcomes of the lesson taking into account GESI (eg. Both gender taking the leading roles in group work, even distribution of questions, provision made for seating of physically challenged) issues and refer them to	**Teaching, learning and assessment activities for the lesson** 3.1 Suggest teaching and learning activities useful for achieving the learning outcomes of the lesson taking into account GESI issues. Read the activities in the course manual lesson 2 and identify those that require clarification (Take note of NTS 1a, b, c, d, 2b, e, f, 3b, c; BSC p. iii).	**40 mins**

of GESI and ICT issues that require clarification.	the activities outlined in the course manual (Ref - writing the weekly PD session-pp 3., Draw tutors attention to NTS 1a, b, c, d, 2b, e, f, 3b, c; BSC p. iii)		
	3.2 Ask tutors to read the activities outlined in the course manual and identify areas that require clarification. ***N/B:*** *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.*	3.2 Read the activities outlined in the course manual and identify areas that require clarification.	
	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. *Example:* *Group Work - Collaborative learning* *Investigation - Critical Thinking* *Role Play - Communication* *Students can ascertain the extent to which methods are used during STS activities in schools.*	3.3 Brainstorm to come up with some pedagogical approaches and their likely related core competencies 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 lesson – 'Assessment as' (Draw tutors' attention to NTS 3k) and group work presentation. Take a	3.4 Discuss the assessment strategies to be used during enactment of the lesson referring to the NTEAP at the various levels (KG, UP, JHS) – 'Assessment as' (Take note	

	sample feedback for each course. ***N/B:*** *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*	of NTS 3k) and group work presentation.	
	3.5 Ask tutors to read and identify the assessment components of the lesson in the course manual focusing on Assessment of, as and for to reflect the demands of the NTEAP	3.5 Read and identify the assessment components of the lesson in the course manual focusing on Assessment of, as and for to reflect the demands of the NTEAP.	
	3.6 Lead tutors to discuss the various ways they can support student teachers to build their portfolios before, during and after lessons.	3.6 Discuss the various ways they can support student teachers to build their portfolios before/during/ after lessons.	
	3.7 Ask a tutor to model a presentation of an activity using ICT tools and taking into consideration GESI issues (eg. Both genders taking the leading roles in their groups and in the demonstration of the use of ICT tools) in the B. ED and the Basic School Curricula (BSC). NTS 1a, b, c, d, 2b, e, 3b, c, J; BSC pp. iii) **NOTE:** *i. Tutors are likely to ask about the relevance of this activity in teaching*	3.7 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the B. ED and the Basic School Curricula (BSC). NTS 1a, b, c, d, 2b, e, 3b, c, J; BSC pp. iii)	

	mathematics lessons. When this comes up, refer them to the PD Theme 1, that is, Creative Approaches *ii. The core and transferable skills being developed or used include social skills, communication skills, critical and creative thinking skills* *iii. Creative Activities, Questioning, Talk and Learn and Group Work can be used to support the delivery of this session*		
Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course assessment components* • *The selected activities should be done with*			

tutors in real or close to real time • *Anticipate any issues for clarification or questions which might arise as the tutors work through the activities and provide guidance on these* • *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied* • *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide guidance on development of these*			

4. Evaluation and review of session: • identification of any outstanding issues relating to this lesson for clarification • Advance preparation In the case of unresolved issues	**Evaluation and review of session:** 4.1 Engage tutors in self-evaluation encouraging them to provide feedback of the PD session taking into consideration being patient with stutterers, using tactile for visually challenged, allowing tutors to show by fingers/nods. (NTS 1a, 3i). 4.2 Engage tutors to reflect on activities and 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* **Advance Preparation** 4.3 Ask tutors to read Lesson 3 of the Course Manual on: **Early Grade** - Fraction concepts: Teaching and Assessing **Upper Primary** - Fraction concepts: Teaching and Assessing) **JHS; Teaching and Assessment** - Fraction concepts: Teaching and Assessing **JHS Calculus** - Derivatives 1: Learning and applying Calculus	**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 understood the lesson. 4.2 Reflect on the activities in the session and outline unresolved issues relating to the lesson **Advance Preparation** 4.3 Read Lesson 3 of the Course Manual on: **Early Grade** - Fraction concepts: Teaching and Assessing **Upper Primary** - Fraction concepts: Teaching and Assessing) **JHS; Teaching and Assessment** - Fraction concepts: Teaching and Assessing **JHS Calculus** - Derivatives 1: Learning and applying Calculus	**15 mins**

	N/B IV. *Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* V. *Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.* VI. *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*	N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring : subject project, subject portfolio preparation and development are explicitly addressed in the PD sessions.			

Age Phase/s:

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

Name of Subject/s: Mathematics:

a. Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Teaching and Assessing JHS
d. Mathematics – Calculus

Tutor PD Session for Lesson 3 in the Course Manual

Lesson of Title: a. Early Grade: Fraction Concepts b. Upper Grade: Fraction Concepts c. JHS (Core) : Fraction Concepts d. JHS (Maths Sp): Learning and Applying Derivatives 1			
Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction • Reflection on previous PD Session (Introduction to the course manual/s)	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity on continuing patterns of numbers (e.g. continue the: i. $\frac{1}{10}\ \frac{1}{100}, \frac{1}{1000}, \frac{1}{10000}, \ldots$ ii. $\frac{3}{10}, \frac{5}{10}, \frac{7}{10}, \frac{9}{10}, \ldots$) 1.2 Ask tutors tell how useful the PD session 2 was and how it influenced their teaching in semester one. (NTS 1b) Note: Draw tutors' attention to all referenced NTSs 1.3 Ask a critical friend to give feedback on his/her observation of the last enacted lesson.	**Introduction** 1.1 Participate in the starter (an investigational activity) on continuing patterns (e.g. continue the: i. $\frac{1}{10}\ \frac{1}{100}, \frac{1}{1000}, \frac{1}{10000}, \ldots$ ii. $\frac{3}{10}, \frac{5}{10}, \frac{7}{10}, \frac{9}{10}, \ldots$) 1.2 Explain how useful the previous PD session influenced your teaching over the week. N/B: Pay attention to all NTS references. 1.3 As the critical friend, share with members feedback on your observation of the last enacted lesson.	

• Introduction and overview of the main purpose of the lesson in the course manual/s • Highlight cross cutting themes i.e., gender equality and social inclusion (GESI), ICT • Identification of important or distinctive aspects of the lesson • Reading and discussion of the introductory sections up to learning outcomes	1.2 Engage tutors through questioning to suggest the purpose of the lesson (NTS 2b) and state their expectations of the PD Session. 1.3 Lead tutors to outline the important features in the course manual and also create awareness of cross cutting and GESI issues (NTS 3j, 3k) 1.4 Ask tutors in pairs discuss to the important or distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters. 1.5 Ask tutors to read the introductory sections (up to learning outcomes) silently. Let tutors in pairs discuss the important or distinctive aspects of the lesson (i.e., the interactive nature of the activities, emphasis a. Early Grade: Fraction Concepts b. Upper Grade: Fraction Concepts c. JHS (Core): Fraction Concepts d. JHS (Maths Sp): Learning and Applying Derivatives 1	1.2 Discuss and explain the purpose of the lesson NTS 2b) in the course manual and state your expectations of the PD session. 1.3 Outline the important features in the course manual taken into consideration cross cutting and GESI issues. 1.4 In pairs discuss the distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters. 1.5 Read the introductory sections (up to learning outcomes) silently. Let tutors in pairs discuss the important or distinctive aspects of the lesson (i.e., the interactive nature of the activities) Refer to Course Manual lesson 3 .	

	NB *EXPECTED QUESTION* • *Why is it important to identify fraction?* • *Why is* $\frac{a}{0}$ *not an expression of fraction? Answers?*		
3. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. This may include GESI and ICT related concepts. • Identification of some misconception and barriers in teaching	**Concept Development** 2.1 Lead tutors to identify familiar and unfamiliar concepts in the lesson and discuss relevant connections among concepts in the lesson with other lessons and the use of relevant resources. 2.2 Engage tutors to identify and discuss various strategies for the development of conceptual understanding of the lesson. Vocabulary and fundamental concepts related to fraction in EGE, fraction in UP, Fraction in JHS course and Derivatives in JHS course. Example: Interactive, Internet search, Model lessons, Exploratory (Let tutors refer to lesson 3 of the course manual for additional strategies.) *Refer to Course Manual, lesson 3* 2.3 Ask tutors to outline possible challenging areas in fraction and derivatives in Calculus taking into consideration GESI.	**Concept Development** 2.1 Identify familiar and unfamiliar concepts in the lesson and discuss relevant connections among concepts in the lesson with other lessons and the use of relevant resources. 2.2 Participate in the identification and discussion and discuss various strategies for the development of conceptual understanding of the lesson. *Refer to Course Manual, lesson 3.* 2.3 Outline possible challenging areas in fraction and derivatives in calculus taking into consideration GESI and	**25 mins**

and learning the concept. • Identification of needed GESI responsive and ICT resources for the teaching and learning of the concept.	Lead tutors how ICT can be applicable in the concept. 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the concepts. 2.5 Support tutors to identify GESI responsive resources such as supporting staff for sign language, projectors, flip charts, sticky notes, tactile that can be used in the teaching and learning of the concepts mentioned above (e.g. curriculum materials (teachers and leaners resource packs, textbooks, course manual, prism and pyramids, etc.) NTS 3j. 2.6 Engage Tutors on how the concepts (e.g. fraction) are used both in school mathematics and life outside the mathematics classroom. 2.7 Ask tutors to outline possible challenging areas in the teaching and learning of these concepts fraction and derivatives. **N/B** • *For instance, fraction expressed as group whole or as a unit whole*.	ICT application in the concept. 2.4 Participate in the discussion on misconceptions and barriers in teaching and learning of the concepts. 2.5 Identify as many GESI responsive resources as possible that can be used in the teaching and learning of the concepts in teaching and assessing, measurement of shape and space and in calculus NTS 3j. 2.6 Discuss how fraction and derivatives concepts are used both in school mathematics and life outside the mathematics classroom. 2.7 Outline possible challenging areas in the teaching and learning of fraction and derivatives	

	• *Also understanding limit as a substitution in derivatives*		
Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be considered prior to taking tutors through the lesson activities "walk through".* • *The resources needed must be identified: literature – page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability* • *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities for the lesson taking into account GESI issues and demonstrate how the LO's of the curriculum can be achieved. eg. i. Provision made for physically challenged	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into account GESI issues and demonstrate achievement of LO's in the curriculum	**40 mins**

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- Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course assessment: subject project (30%), subject portfolio (30%) and end of semester examination (40%)

- Working through one or two activities,

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ii. Both genders take leading roles in group task
iii. Even distribution of questions
Ref: Writing the weekly PD session-pp, NTS 1a, b, c, d, 2b, e, f, 3b, c

3.2 Ask tutors to read the activities outlined in the course manual 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.

Strategy	**Core Competency**
Group Work	Collaborative learning
Investigation	Critical Thinking
Role Play	Communication

3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson – 'Assessment as' (NTS 3k). Encourage tutors to discuss the mode of Assessment (working in group or individual by presentation, exercises, etc)

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3.2 Read the activities outlined in the 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 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson – 'Assessment as' (NTS 3k). Discuss the mode of Assessment (working in group or individual by presentation, exercise, etc)

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	Assessment must be aligned to the NTEAP and required course Assessment 3.5 Lead tutors to discuss the various ways they can support student teachers to build their portfolio. 3.6 Ask a tutor to model a presentation of an activity using ICT tools and taking into consideration GESI issues (eg. Both genders taking the leading roles in their groups and in the demonstration of the use of ICT tools) in the lesson **Teaching and Assessing of Fraction Concept and Learning and Applying Derivatives 1.** NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii) 3.7 Students can ascertain the extent to which pedagogy is used during STS activities in schools. 3.8 Engage tutors in a discussion of inclusive strategies to clarify the otherwise dark spots (e.g. using Selection model for fraction problems and principle of multiple embodiment etc.) 3.9 Engage tutors in pairs to discuss strategies to strengthen core competencies (e.g.	3.5 Lead tutors to discuss the various ways they can support student teachers to build their portfolio. 3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons; **Teaching and Assessing and Learning and Applying Derivatives 1.** NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii) 3.7 Students can ascertain the extent to which pedagogy is used during STS activities in schools. 3.8 Engage tutors in a discussion of inclusive strategies to clarify the otherwise dark spots (e.g. using Selection model for fraction problems and principle of multiple embodiment etc.) 3.9 Engage tutors in pairs to discuss strategies to strengthen core competencies (e.g. mind-	

	mind- reading word puzzle, investigation, etc.). NB *Tutors are likely to ask about the relevance of this activity in teaching mathematics lessons. When this comes up, refer them to PD Manuals:* *i. that is, Creative Approaches* *ii. the core and transferable skills being developed or used include social skills, communication skills, critical and creative thinking skills* *iii. creative Activities, Questioning, Talk and Learn and Group Work can be used to support the delivery of this session.*	reading word puzzle, investigation, etc.).	
Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course*			

assessment components • *The selected activities should be done with tutors in real or close to real time* • *Anticipate any issues for clarification or questions which might arise as the tutors work through the activities and provide guidance on these* • *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied* • *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide*			

guidance on development of these			
4. Evaluation and Review of session: • identification of any outstanding issues relating to this lesson for clarification • Advance Preparation	**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 (NTS 1a, 3i). Engage tutors to identify unresolved issues relating to this lesson for clarification. 4.2 Ask tutors in pair mention how GESI issues was used in the lesson 4.3 Lead tutors to discuss the strategies required to resolve the unresolve issues identified. NB *Take note of all unresolved issues and use any of following strategies* – *put on SL/SWL WhatsApp, Telegram platform for discussion* – *tutors to research for the next PD session for discussion* **Advance Preparation** 4.5 Ask tutors to read Lesson 4 of the Course Manual on: **Early Grade** - Teaching and Assessing operations on Fractions	**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 In pair mention how GESI issues was used in the lesson *Discuss the strategies you will use to resolve the unresolved issues* **Advance Preparation** 4.4 Read Lesson 4 of the Course Manual on: **Early Grade** - Teaching and Assessing operations on Fractions	**5 mins**

• In the case of unresolved issues	**Upper Primary** - Teaching and Assessing operations on Fractions **JHS** - Teaching and Assessing operations on Fractions **JHS Calculus** – Learning and Applying Derivatives 2 N/B *VII. Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* *VIII. Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to this lesson for clarification.* *IX. Collect all 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*	**Upper Primary** - Teaching and Assessing operations on Fractions **JHS -** Teaching and Assessing operations on Fractions **JHS Calculus** - Learning and Applying Derivatives 2 N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination.			

This means ensuring: subject project, subject portfolio preparation and development are explicitly addressed in the PD sessions.	

Age Phase/s:

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

Name of Subject/s:

a. Mathematics: Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Teaching and Assessing JHS
d. Mathematics – Calculus

Tutor PD Session for Lesson 4 in the Course Manual

Lesson Title: **a. Early Grade:** Operations on fractions **b. Upper Grade:** Operations on fractions **c. JHS (Core):** Operations on fractions **d. JHS (Maths Sp):** Derivatives 2: Learning and applying			
Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction / lesson overview • Overview of subject/s age phase/s to be covered in this PD session and how it will be organised. Including guidance on grouping tutors according to the subject/s, age phase/s. • Reflection on previous PD Session (Introduction to the course manual/s) • Introduction and overview of the main purpose of the lesson in the course manual/s • Identification of important or	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity according to the subjects and age phases (e.g. early grade: arithmetic operation on fractions, $\frac{1}{3}+\frac{2}{3}, \frac{1}{5}+\frac{2}{5}, \frac{1}{7}+\frac{2}{7}, \ldots$ Calculus: the rate of change of slope when climbing or descending a mountain , rate of change of the heartbeat when walking) 1.2 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 developing an*	**Introduction** 1.1 Engage tutors in an investigational activity according to the subjects and age phases (e.g. early grade: arithmetic operation on fractions, $\frac{1}{3}+\frac{2}{3}, \frac{1}{5}+\frac{2}{5}, \frac{1}{7}+\frac{2}{7} \ldots$ Calculus: the rate of change of slope when climbing a mountain , rate of change of the heartbeat when Walking) 1.2 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. N/B: Pay attention to all NTS references.	

distinctive aspects of the lesson/s • Reading and discussion of the introductory sections up to learning outcomes	*understanding of operations on fractions: (Teaching and Assessment) with respect to operations on fraction within the basic school curriculum.* *ii.* ***JHS (Maths Sp) considers*** *The lesson seeks to develop student teachers' concepts and assessment strategies based on differentiation. The areas to be covered include transcendental function, Implicit functions and special attention will be given to continuity of polynomial and rational functions.* N/B: Draw tutors' attention to all NTS references. 1.3 Ask a critical friend to give feedback on observation during the enactment of lesson 3. 1.4 Ask tutors to suggest the purpose of the lesson and state their expectations of the PD Session. 1.5 Ask tutors to read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate 1.6 Guide tutors to establish the linkage between CLOs and the LOs of the lesson 1.7 Aks tutors in pairs to discuss the important or	 1.3 As a critical friend, share with members feedback on observation during the teaching of lesson 3. 1.4 Engage tutors to suggest the purpose of the lesson and state your expectations of the PD Session. 1.5 Read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate 1.6 Participate in the identification of the CLOs and link them to the LOs of the lesson 1.7 In pairs, discuss the distinctive aspects of the	

	distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters. ***Distinctive aspects*** *include the interactive nature of the activities, emphasis on connecting concepts and assessment strategies:* *a. Early Grade– eg. operations on fractions and the efficient use of TLMs with an appropriate form of assessment.* *b. Upper Grade – eg. the use of ICT and TLMs in the operations on fractions.* *c. JHS (core) – eg. the use of ICT and TLMs in the operations on fractions.* *d. JHS(Calculus) – eg. application of calculus in real life situations* 1.8 Ask tutors to read and discuss the introductory sections of the lesson (up to Learning Outcomes). and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson. N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *iv. How can an assessment strategy be infused into the learning process of operations on fractions?* *v. What is the relationship between limit of a function*	lesson including vocabulary and fundamental concepts related to the components of the front matters. 1.8 Read and discuss the introductory sections of the lesson (up to Learning Outcomes). and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson.	

	and the derivative of a function?		
The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which might arise from the introduction to the lesson and provide responses for SL/HoD.* • *Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD*			
2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. • Identification of needed resources for the teaching and learning of the concept.	**Concept Development** 2.1 Lead tutors to identify familiar and unfamiliar concepts in the lesson and discuss connections among concepts in the lesson. 2.2 Ask tutors to outline possible challenging areas in teaching and assessing operations on fractions and teaching calculus taking into consideration GESI Eg. The use of differentiated instruction to cater for the	**Concept Development** 2.1 Identify familiar and unfamiliar concepts in the lesson and discuss connections among concepts in the lesson. 2.2 Outline possible challenging areas in teaching and assessing operations on fractions and in Calculus taking into consideration **GESI**.	**25 mins**

	needs of all children in the early and upper grade and JHS classrooms, including those with special educational needs and creating a safe, secure, happy and stimulating learning environment (NTS 3c 3f, pg. 14).		
	2.3 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. Eg. i) Operations on fractions: $\frac{1}{4}+\frac{2}{3}=\frac{1+2}{4+3}$ ii) calculus: derivative of a function has no relationship with the limit of that function.	2.3 Participate in the discussion on misconceptions and barriers in teaching and learning of the lesson.	
	2.4 Support tutors to identify GESI responsive resources such as supporting staff for sign language, projectors, flip charts, sticky notes, tactile that can be used in the teaching and learning of the concepts mentioned above (e.g. curriculum materials, teachers and leaners resource packs, textbooks, course manual, etc.) NTS 3j	2.4 Identify as many GESI responsive resources as possible that can be used in the teaching and learning of the concepts in teaching and assessment of operations on fractions and exploring concepts of limit and derivatives of a function NTS 3j	
	i. Need to identify any aspect of the lesson that might be challenging for tutors in terms of new learning which need to be considered prior to taking tutors through the lessons.		
	ii. Need to identify needed resources well suited for each lesson according to		

	the subject and age phase: where appropriate, indicate the literature page referenced etc., on web, utube, powerpoint, physical reources		
Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be considered prior to taking tutors through the lesson activities "walk through".* • *The resources needed must be identified: literature – page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability* • *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification	**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	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into account GESI issues.	**40 mins**

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Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course assessment: subject project (30%), subject portfolio (30%) and end of semester examination (40%)
Working through one or two activities,

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ii. Both genders take leading roles in group task
iii. Even distribution of questions
Ref: Writing the weekly PD session-pp 3., NTS 1a, b, c, d, 2b, e, f, 3b, c

3.2 Ask tutors to read the activities outlined in the course manual 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.
<table>
<tr><th>Strategy</th><th>Core Competency</th></tr>
<tr><td>Group Work</td><td>Collaborative learning</td></tr>
<tr><td>Investigation</td><td>Critical Thinking</td></tr>
<tr><td>Role Play</td><td>Communication</td></tr>
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3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson – ‘Assessment as’ (NTS 3k).
Assessment must be aligned to the NTEAP and required course Assessment to include subject project (30%), subject portfolio (30%) and end of semester examination (40%)

3.5 Lead tutors to discuss the various ways they can support student teachers
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3.2 Read the activities outlined in the 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 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson – ‘Assessment as’ (NTS 3k).

3.5 Lead tutors to discuss the various ways they can
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	to build their portfolio and subject projects. 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) in the lesson; operations on fractions (Teaching and Assessing) and rate of change and derivatives in Calculus**.** NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	support student teachers to build their portfolio 3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons; (Teaching and Assessing) and rate of change and derivatives in Calculus**.** NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	
Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience . These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course assessment components* • *The selected activities should be*			

done with tutors in real or close to real time • *Anticipate any issues for clarification or questions which might arise as the tutors work through the activities and provide guidance on these* • *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied* • *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide guidance on development of these*			

5. Evaluation and review of session: • identification of any outstanding issues relating to this lesson for clarification • Advance preparation • In the case of unresolved issues	**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 (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* – *put on SL/SWL WhatsApp platform for discussion* – *tutors to research for the next PD session for discussion* **Advance Preparation** 4.3 Ask tutors to read Lesson 5 of the Course Manual on: **Early Grade** - Micro Lessons and use of technology across Early Grade numeracy: (Teaching and Assessing) **Upper Primary** - Micro Lessons and use of technology across Primary school numeracy: (Teaching and Assessing) **JHS-** Micro Lessons and use of technology across JHS numeracy: (Teaching and Assessing) **JHS Calculus** -Curve sketching, maxima and minima;	**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 **Advance Preparation** 4.3 Read Lesson 5 of the Course Manual on: **Early Grade** - Place value: (Teaching and Assessing) **Upper Primary** - Counting and Number Relationships **JHS; Teaching and Assessment** - Construction, Angles and Polygons: (Teaching and Assessing 2) **JHS Calculus** - Limits and Continuity: Learning and applying	**5 mins**

	N/B X. *Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* XI. *Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to this lesson for clarification.* XII. *Collect all 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*	N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring : subject project, subject portfolio preparation and development are explicitly addressed in the PD sessions.			

Age Phase/s:

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

Name of Subject/s:

a. Mathematics: Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Teaching and Assessing JHS
d. Mathematics – Calculus

Tutor PD Session for Lesson 5 in the Course Manual

Lesson Tittle: a. Early Grade - Micro Lessons and use of technology across Early Grade numeracy b. Upper Grade - Micro Lessons and use of technology across Primary school numeracy c. JHS (CORE) - Micro Lessons and use of technology across JHS numeracy d. JHS (SP) - Curve sketching, maxima and minima			
Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction / lesson overview • Overview of subject/s age phase/s to be covered in this PD session and how it will be organised. Including guidance on grouping tutors according to the subject/s, age phase/s. • Reflection on previous PD Session (Introduction to the course manual/s) • Introduction and overview of the main purpose of the lesson in the course manual/s • Identification of important or	**Introduction** 1.1 Ice breaker activity: Begin with an interesting story about a micro lesson observed or participated in. 1.2 Ask tutors to tell how useful the previous PD session was and how it influenced their teaching over the week and 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. 1.3 Ask the critical friend to give feedback on his/her	**Introduction** 1.1 Tell an interesting story about a micro lesson you observed or participated in. 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 all NTS references. 1.3 As a critical friend, give feedback on your	

distinctive aspects of the lesson/s • Reading and discussion of the introductory sections up to learning outcomes	observation of the last enacted lesson. 1.4 Lead tutors to discuss any challenges that arose during the enactment. Eg In what ways did the students appreciate the need to consider equality and equity during the lesson and during STS activities? 1.5 Ask tutors to read the course manual and identify the purpose of the lesson Ask members to state their expectations of the PD Session on lesson 5. (NTS 2b). 1.6 Lead tutors in pairs to discuss the important or distinctive aspects of lesson 5 such as vocabulary and fundamental concepts related to the lesson including 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. Using mathematical learning pedagogy and resources to plan, carry out and critique micro lessons based.* *b. Upper Grade – eg. Using mathematical learning pedagogy and resources to*	observation of the previous enacted lesson. 1.4 Discuss any challenges that arose during the enactment. 1.5 Read the course manual and identify the purpose of the lesson (NTS 2b). State your expectations of the PD Session. 1.6 In pairs, discuss the important or distinctive aspects of lesson 5 such as vocabulary and fundamental concepts related to the lesson including developing awareness of equity and diversity issues and issues on ICT.	

	plan, carry out and critique micro lessons based. *c. JHS; Assessment – eg. Using mathematical learning pedagogy and resources to plan, carry out and critique micro lessons based.* *d. JHS; Calculus – eg. using graph sheets to investigate maxima and minima* 1.7 Ask tutors to read individually and discuss in pairs the introductory sections of the lesson (up to Learning Outcomes). N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *i.How can the micro teaching classroom be made useful?* *At what point do we have maxima and minima?*	1.7 Read individually and discuss the introductory sections of the lesson (up to Learning Outcomes).	
The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which might arise from the introduction to the lesson and provide responses for SL/HoD.*			

• *Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD*			
2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. • Identification of needed resources for the teaching and learning of the concept.	**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. 2.3 Using think pair share, ask tutors to outline possible challenging areas in teaching and assessing Micro lessons and using curve sketching to identify maxima and minima. Take into consideration GESI (eg. Use motivating statements such as: "You have done well" irrespective of physical or social condition of learner). 2.4 Ask tutors to suggest creative approaches for addressing the identified challenges. Eg. Using group work, the principle of multiple embodiment, problem solving, internet search. 2.5 Lead tutors to discuss misconceptions and	**Concept Development** 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 Through think-pair-share, outline possible challenging areas in teaching and assessing Micro lessons and using curve sketching to identify maxima and minima. Take into consideration GESI. 2.4 Mention creative approaches for addressing the identified challenges. 2.5 Discuss misconceptions and barriers in teaching	

	barriers in teaching and learning of the lesson. Example: a. Early/Upper/JHS (Core) Grade – Some people are born teachers and so they do better b. JHS (Calculus) – Calculus is for boys ***Barrier:*** *inappropriate inclusive resources, technology and pre-requisite knowledge* 2.6 Focusing on one Phase at a time, ask tutors to identify GESI responsive resources that can be used to achieve the LOs. *N/B: Such resources include supporting staff for sign language, projectors, flip charts, sticky notes, tactile that can be used in the teaching and learning of the concepts mentioned above. other materials are curriculum materials, graph sheets, etc.) NTS 3j*	and learning of the lesson. 2.6 2.6 Identify GESI responsive resources that can be used to achieve the LOs.	
Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be considered prior to taking tutors through the lesson activities "walk through".* • *The resources needed must be identified: literature*			

– page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability • *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification • Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course assessment: subject project (30%), subject portfolio (30%) and end of semester examination (40%) • Working through one or two activities,	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities useful for achieving the learning outcomes of the lesson taking into account GESI. eg. i. Consider pairing male to a female where feasible for team teaching ii. Provision made for physically challenged during grouping iii. Both genders take leading roles in group task iv. Even distribution of questions NTS 1a, b, c, d, 2b, e, f, 3b, c, BSC p. iii) 3.2 Ask tutors to read the activities outlined in the course manual and identify areas that require clarification. ***N/B:*** *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.*	**Teaching and learning activities** 3.1 Suggest teaching and learning activities useful for achieving the learning outcomes of the lesson taking into account GESI. 3.2 Read the activities outlined in the course manual and identify areas that require clarification.	

	3.3 Lead tutors through brainstorming 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. *Example:* *Group Work - Collaborative learning* *Investigation - Critical Thinking* *Role Play - Communication* *Students can ascertain the extent to which methods are used during STS activities in schools.*	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 lesson – 'Assessment as' (NTS 3k) and group work presentation. ***N/B:*** *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) and group work presentation.	
	3.5 Lead tutors to discuss the various ways they can support student teachers to build their project and portfolio before/during/ after lessons.	3.5 Discuss the various ways they can support student teachers to build their portfolio.	

	3.6 Ask a tutor to 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) in the lesson Teaching and Assessing and in Calculus. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii) With the help of a Lesson Observation Guide, lead tutors to reflect on the modelled lesson.	3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons; Teaching and Assessing and in Calculus. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii) With the help of a Lesson Observation Guide, reflect on the modelled lesson.	
Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course assessment components* • *The selected activities should be done with tutors in*			

real or close to real time • *Anticipate any issues for clarification or questions which might arise as the tutors work through the activities and provide guidance on these* • *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied* • *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide guidance on development of these*			

4. Evaluation and review of session: • identification of any outstanding issues relating to this lesson for clarification • Advance preparation • In the case of unresolved issues	**Evaluation and review of session:** 4.1 Encourage tutors to provide feedback of the PD session taking into consideration inclusivity – how to be patient with stutterers, using tactile for the visually challenged, allowing tutors to show by fingers/nods. (NTS 1a, 3i). 4.2 Ask tutors to identify unresolved issues relating to this lesson for clarification ***N/B:*** *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* **Advance Preparation** 4.3 Ask tutors to read Lesson 6 of the Course Manual on: **Early Grade** - Diagnosis and remediation; assessment resources/records, and monitoring progress: (Teaching and Assessing **Upper Primary** - Diagnosis and remediation; assessment resources/records, and monitoring progress **JHS;** - Diagnosis and remediation; assessment resources/records, 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 **Advance Preparation** 4.3 Read Lesson 2 of the Course Manual on: **Early Grade** - Diagnosis and remediation; assessment resources/records, and monitoring progress: (Teaching and Assessing **Upper Primary** - Diagnosis and remediation; assessment resources/records, and monitoring progress **JHS;** - Diagnosis and remediation; assessment resources/records, and monitoring progress (Teaching and Assessing 2)	**5 mins**

	monitoring progress (Teaching and Assessing 2) **JHS Calculus** - Linear kinematics: Learning and applying N/B XIII. *Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* XIV. *Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.* XV. *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*	**JHS Calculus** - Linear kinematics: Learning and applying N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring: subject project, subject portfolio preparation			

and development are explicitly addressed in the PD sessions.			

Age Phase/s:

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

Name of Subject/s:

a. Mathematics: Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Mathematics: Teaching and Assessing JHS
d. Mathematics – Learning and Applying Calculus

Tutor PD Session for Lesson 6 in the Course Manual

Lesson Title:

e. **Early Grade:** Diagnosis and remediation; assessment resources/records, and monitoring progress
f. **Upper Grade:** Diagnosis and remediation; assessment resources/records, and monitoring progress
g. **JHS (Core):** Diagnosis and remediation; assessment resources/records, and monitoring progress
h. **JHS (Maths Sp):** Learning and Applying Derivatives 2

Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction • Overview of subject/s age phase/s to be covered in this PD session and how it will be organised. Including guidance on grouping tutors according to the subject/s, age phase/s.	**Introduction** 1.1 Ice breaker activity: Begin with a reinforcement game (Counter game) activity by asking tutors to shake and spill a select group of colour counters on their workspace and compare their counters with a partner. *N/B: This game will consolidate writing number sentences, interpreting mathematical word problems, and organizing and interpreting data symbolically.* N/B: Draw tutors' attention to all NTS references. 1.2 Ask tutors to discuss the overview of the phases to	**Introduction** 1.1 Pick a bag containing colour counters. shake and spill a select group of colour counters on their workspace and compare their counters with a partner. *N/B: This game will consolidate writing number sentences, interpreting mathematical word problems, and organizing and interpreting data symbolically.* N/B: Pay attention to all NTS references. 1.2 Discuss the overview of the phases to be	

• Reflection on previous PD Session (Introduction to the course manual/s) • Introduction and overview of the main purpose of the lesson in the course manual/s	be covered in this PD session and how it will be organized. *i. Early, Upper Grade and JHS (doing core): The lesson considers developing an understanding of Diagnosis and remediation; assessment resources/records, and monitoring progress. It also considers how the various assessment strategies can be incorporated in the lesson as well as in the Basic School classroom.* *ii. JHS – Calculus considers definitions of derivatives, derivatives of polynomial and rational functions. It seeks to develop learner's knowledge to establish and address learning needs, perceptions and misconceptions of concepts based on differentiation. es.* **N/B**: *Remember to put members into groups according to the phases to be taught in the semester.* 1.3 Ask tutors to tell how useful the PD session 5 was and how it influenced their teaching over the week and how students were well placed to employ the various strategies and skills during the Basic School classroom work including STS experience. (NTS 1b) 1.4 Ask tutors to identify the purpose of the lesson from the course manual and	covered in this PD session and how it will be organized. 1.3 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 experience. 1.4 Identify the purpose of the lesson from the course manual and	

	state their expectations of the PD Session 1.5 Ask the critical friend to give feedback on his/her observation of the last enacted lesson.	state your expectations of the PD Session. 1.5 As a critical friend, give feedback on your observation of the previous enacted lesson.	
• Identification of important or distinctive aspects of the lesson • Reading and discussion of the introductory	1.6 Ask tutors to read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate. 1.7 Guide tutors to establish the relationship between CLOs and the learning outcomes of individual lessons in the course 1.8 Ask tutors in phase groups to discuss the important or distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters. ***Distinctive aspects*** *include the interactive nature of the activities, emphasis on connecting concepts:* *a. Early Grade– eg. understand heuristics measures of learners learning needs through: diagnosis and remediation, assessment resources/ records and monitoring progress.* *b. Upper Grade – eg. understand heuristics measures of learners learning needs through: diagnosis and remediation, assessment*	1.6 Read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate. 1.7 Guide tutors to establish the relationship between CLOs and the learning outcomes of individual lessons in the course. 1.8 In phase groups, discuss the distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters.	

sections up to learning outcomes	*resources/ records and monitoring progress.* *c. JHS (Core)- understand heuristics measures of learners learning needs through: diagnosis and remediation, assessment resources/ records and monitoring progress.* *d. JHS; Calculus – relationship between displacement, velocity, acceleration and velocity-time graph* 1.9 Ask tutors to read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson. N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *i. What are some of the misconceptions in Mathematics at the basic school?* *ii. How will you diagnose the misconception that there are no numbers between 2.2 and 2.3?* *iii. What is the difference between position and velocity?*	1.9 Read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson.	

The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which might arise from the introduction to the lesson and provide responses for SL/HoD.* *Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD*			
2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. This may include GESI and	**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. 2.3 Ask tutors to outline possible challenging areas in Teaching and Assessing linear kinematics in Calculus taking into consideration GESI (eg. the challenging areas include diagnosis of fractions, application of: displacement, velocity, and	**Concept Development** 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 and Assessing linear kinematics in calculus taking into consideration GESI.	**25 mins**

ICT related concepts. • Identification of some misconception and barriers in teaching and learning the concept. • Identification of needed GESI responsive and ICT resources for the teaching and learning of the concept.	acceleration and GESI: TLMs should cater for all students and encourage all students in the teaching and learning of kinematics) 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. Example: *a. Early Grade – Mathematics is not applicable to real life.* *b. Upper Grade –those who are good in Mathematics are born with natural ability* *c. JHS (CORE) – Mathematics is all about memorization.* *d. JHS (Calculus) – if speed of the object is constant then acceleration is zero.* 2.5 Focusing on one Phase at a time, support tutors to identify GESI responsive resources that can be used to achieve the LOs. *N/B: Such resources include supporting staff for sign language, projectors, flip charts, sticky notes, tactile that can be used in the teaching and learning of the concepts mentioned above. other materials are curriculum materials, graph sheets, etc.) NTS 3j*	2.4 Discuss the misconceptions and barriers in teaching and learning of the lesson. 2.5 Identify GESI responsive resources that can be used to achieve the LOs.	
Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be considered prior to*			

taking tutors through the lesson activities "walk through". • *The resources needed must be identified: literature – page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability* • *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities for the lesson taking into account GESI issues and demonstrate how the LO's and LI's of the curriculum can be achieved. 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 Ask tutors to read the activities outlined in the course manual and identify	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into account GESI issues and demonstrate achievement of LO's and LI's in the curriculum 3.2 Read the activities outlined in the course manual and identify	**40 mins**

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- Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course assessment: subject project (30%), subject portfolio (30%) and end of semester examination (40%)
- Working through one or two activities,

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areas that require clarification.

N/B: *Strategies and techniques 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.

<table>
<tr><th>Strategy</th><th>Core Competency</th></tr>
<tr><td>Group Work</td><td>Collaborative learning</td></tr>
<tr><td>Investigation</td><td>Critical Thinking</td></tr>
<tr><td>Role Play</td><td>Communication</td></tr>
</table>

3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson – 'Assessment as' (NTS 3k). Encourage tutors to discuss the mode of Assessment (working in group or individual by presentation, exercises, etc)

Assessment must be aligned to the NTEAP and required course Assessment. Continuous assessment activities (assignments, quizzes, group presentations, etc, should be used to create subject projects and build subject portfolios

3.5 Lead tutors to discuss the various ways they can support student teachers to build their portfolio.

NB: Assign student teachers to develop equivalent fractions

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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 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson – 'Assessment as' (NTS 3k). Discuss the mode of Assessment (working in group or individual by presentation, exercise, etc)

3.5 Lead tutors to discuss the various ways they can support student teachers to build their portfolio.

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	from locally available resources to share among colleagues and also write a report on the teaching of the lesson. 3.6 Ask a tutor to 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) in the lesson Teaching and Assessing Diagnosis and remediation; assessment resources/ records, and monitoring progress and teaching and applying kinematics**.** NTS 1a, b, 2b, e, 3b, c, J; BSC. 3.7 Lead tutors to discuss how student teachers can apply the pedagogy developed in the lesson during STS activities in basic schools. NB *Tutors are likely to ask about the relevance of this activity in teaching mathematics lessons. When this comes up, refer them to PD Manuals:* *i. that is, Creative Approaches* *ii. the core and transferable skills being developed or used include social skills, communication skills, critical and creative thinking skills* *iii. creative Activities, Questioning, Talk and Learn and Group Work can be used to support the delivery of this session.*	3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons; Teaching and Assessing diagnosis and remediation; assessment resources/ records, and monitoring progress **and** teaching and applying kinematics**.** NTS 1a, b, 2b, e, 3b, c, J; BSC. 3.7 Discuss how student teachers can apply the pedagogy developed in the lesson during STS activities in basic schools.	

Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course assessment components* • *The selected activities should be done with tutors in real or close to real time* • *Anticipate any issues for clarification or questions which might arise as the tutors work through the activities and provide guidance on these* • *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied*			

• *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide guidance on development of these*			
4. Evaluation and Review of session: • identification of any outstanding issues relating to this lesson for clarification	**Reflective Activity** 4.1 Encourage tutors to provide feedback of the PD session taking into consideration GESI (how to be patient with stutterers, using tactile 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 Ask tutors in pairs to mention how GESI issues were used in the lesson. 4.3 Engage tutors to identify unresolved issues relating	**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 Mention how GESI issues were used in the lesson 4.3 Reflect on the activities in the session and outline unresolved	**5 mins**

In the case of unresolved issues • Advance Preparation	to this lesson for clarification. 4.4 Lead tutors to discuss the strategies required to resolve the unresolve issues identified. NB *i. Take note of all unresolved issues and use any of following strategies* *ii. put on SL/SWL WhatsApp, Telegram platform for discussion.* *iii. tutors to research for the next PD session for discussion* **Advance Preparation** 4.5 Ask tutors to read Lesson 7 of the Course Manual on: **Early Grade** - Teaching and Assessing Shape, Space and Measurement **Upper Primary** - Teaching and Assessing Shape, Space and Measurement **JHS** - Teaching and Assessing Shape, Space and Measurement **JHS Calculus** – Learning and Applying Integration 1 N/B *i. Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* *ii. Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to this lesson for clarification.*	issues relating to the lesson. 4.4 Discuss the strategies you will use to resolve the unresolved issues **Advance Preparation** 4.5 Read Lesson 5 of the Course Manual on: **Early Grade** - Teaching and Assessing Shape, Space and Measurement **Upper Primary** - Teaching and Assessing Shape, Space and Measurement **JHS -** Teaching and Assessing Shape, Space and Measurement **JHS Calculus** - Learning and Applying Integration 1 N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	

	iii. Collect all 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		
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring: subject project, subject portfolio preparation and development are explicitly addressed in the PD sessions.			

Age Phase/s:

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

Name of Subject/s:

a. Mathematics: Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Teaching and Assessing JHS
d. Mathematics – Calculus

Tutor PD Session for Lesson 7 in the Course Manual

Lesson Title:
a. Early Grade: Shape, Space and Measurement: (Teaching and Assessment)
b. Upper Grade: Shape, Space and Measurement: (Teaching and Assessment)
c. JHS (Core): Shape, Space and Measurement: (Teaching and Assessment)
d. JHS (Maths Sp): Integration 1: Learning and applying

Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction / lesson overview • Overview of subject/s age phase/s to be covered in this PD session and how it will be organised. Including guidance on grouping tutors according to the subject/s, age phase/s. • Reflection on previous PD Session (Introduction to the course manual/s) • Introduction and overview of the main purpose of the lesson in the course manual/s	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity according to the subjects and age phases (e.g. select an object and identify the number of edges and faces in 7 seconds) 1.2 Expose tutors to the overview of the subject age phases to be covered in this PD session and how it will be organised. *iii.* ***Early and upper grade and JHS (Core)*** *lessons focus on developing an understanding of Teaching and assessing early and upper grade and JHS (core) Mathematics*	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity according to the subjects and age phases. (e.g. select an object and identify the number of edges and faces in 7 seconds) 1.2 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. N/B: Pay attention to all NTS references.	

• Identification of important or distinctive aspects of the lesson/s • Reading and discussion of the introductory sections up to learning outcomes	*especially, Shape, Space and Measurement within the basic school curriculum.* *iv. **JHS (Maths Sp)** lesson seeks to develop student teachers' concepts of integration as an inverse of differentiation to establish the rule of integration of polynomials and the use of integration to find areas and volumes.* N/B: Draw tutors' attention to all NTS references. 1.3 Ask a critical friend to give feedback on observation during the enactment of lesson 6. 1.4 Ask tutors to tell how useful the previous PD session was and how it influenced their teaching over the week. 1.5 Ask tutors to suggest the purpose of the lesson and state their expectations of the PD Session. 1.6 Ask tutors to read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate 1.7 Guide tutors to establish the linkage between CLOs and the LOs of the lesson	1.3 As a critical friend, share with members feedback on observation during the teaching of lesson 6. 1.4 Explain how useful the previous PD session influenced their teaching over the week. 1.5 Engage tutors to suggest the purpose of the lesson and state your expectations of the PD Session. 1.6 Read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate 1.7 Participate in the identification of the CLOs and link them to the LOs of the lesson	

	1.8 Ask tutors in pairs discuss the important or distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters. ***Distinctive aspects*** *include the interactive nature of the activities with emphasis on connecting concepts (creating addition facts, Effective assessment skills, key features of the basic school curriculum, applying a topic to real life* with *other lessons and the use of relevant resources*. *a. Early Grade– eg. the use of TLMs to develop understanding of such attributes as length, angle, area, volume and capacity, time, and money.* *b. Upper Grade – eg. Activation of group project work, ICT and TLM to help student teachers develop understanding of such attributes as length, angle, area, volume and capacity, time, and money* *c. JHS(core) – eg. Activation of group project work, ICT and TLM to help student teachers develop understanding of such attributes as length, angle, area, volume and capacity, time, and money* *d. JHS (Math sp) – eg. application of integration to finding areas and volumes in real life situations*	1.8 In pairs discuss the distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters.	

	1.9 Ask tutors to read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson. N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *vi. How can an assessment strategy be infused into the learning process of operations on fractions?* *vii. Why worry ourselves with integration if we can find areas and volumes of regular shapes?*	1.9 Read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson.	
The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which might arise from the introduction to the lesson and provide responses for SL/HoD.* • *Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD*			

2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. • Identification of needed resources for the teaching and learning of the concept.	**Concept Development** 2.1 Lead tutors to identify familiar and unfamiliar concepts in the lesson and discuss connections among concepts in the lesson. 2.2 Ask tutors to outline possible challenging areas in the teaching and assessment of lesson 'Shape, Space and Measurements' and the teaching of integration taking into consideration GESI 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 and creating a safe, secure, happy and stimulating learning environment (NTS 3c 3f, pg. 14).* 2.3 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. Eg. i) volume is the same as capacity ii) calculus: integration is a routine calculation of a number based on some formulas. 2.4 Support tutors to identify GESI responsive resources such as supporting staff for sign language, projectors, flip charts, sticky notes,	**Concept Development** 2.1 Identify familiar and unfamiliar concepts in the lesson and discuss connections among concepts in the lesson. 2.2 Outline possible challenging areas in the teaching and assessing 'Shape, Space and Measurements' and in Calculus taking into consideration **GESI**. 2.3 Participate in the discussion on misconceptions and barriers in teaching and learning of the lesson. 2.4 Identify as many GESI responsive resources as possible that can be used in the teaching and learning of the concepts in teaching and	**25 mins**

	tactile that can be used in the teaching and learning of the concepts mentioned above (e.g. curriculum materials, teachers and leaners resource packs, textbooks, course manual, etc.) NTS 3j i. *Need to identify any aspect of the lesson that might be challenging for tutors in terms of new learning which need to be considered prior to taking tutors through the lessons.* ii. *Need to identify needed resources well suited for each lesson according to the subject and age phase: where appropriate, indicate the literature page referenced etc., on web, utube, powerpoint, physical resources*	assessment of operations on fractions and exploring concepts of limit and derivatives of a function NTS 3j	
Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be considered prior to taking tutors through the lesson activities "walk through".* • *The resources needed must be identified: literature – page referenced etc, on web, Utube, physical resources,*			

power point; how they should be used. Consideration needs to be given to local availability • *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification • Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course assessment: subject project (30%), subject portfolio (30%) and end of semester examination (40%) • Working through one or two activities,	**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 Ref: Writing the weekly PD session-pp 3., NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Let tutors read the activities outlined in the course manual 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.	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into account GESI issues. 3.2 Read the activities outlined in the 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.	**40 mins**

	<table><tr><th>Strategy</th><th>Core Competency</th></tr><tr><td>Group Work</td><td>Collaborative learning</td></tr><tr><td>Investigation</td><td>Critical Thinking</td></tr><tr><td>Role Play</td><td>Communication</td></tr></table> 3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson. (NTS 3k). *Assessment must be aligned to the NTEAP and required course Assessment to include subject project (30%), subject portfolio (30%) and end of semester examination (40%)* 3.5 Lead tutors to discuss the various ways they can support student teachers to build their portfolio and subject projects. 3.6 Ask tutors to 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) in the lesson; shapes, space and measurement (Teaching and Assessing) and integration. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii) Note *i. Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors* *ii. The selected activities should be done with*	3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson (NTS 3k). 3.5 Discuss the various ways they can support student teachers to build their portfolio 3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons; shapes, space and measurement (Teaching and Assessing) and integration. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	

	tutors in real or close to real time *iii. Identify where, and which, core and transferable skills, including 21st skills and the use of information skills*		
Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course assessment components* • *The selected activities should be done with tutors in real or close to real time* • *Anticipate any issues for clarification or questions which might arise as the tutors work through the activities and provide guidance on these*			

• *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied* • *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide guidance on development of these*			
4. Evaluation and review of session: • identification of any outstanding issues relating to this lesson for clarification • Advance preparation • In the case of unresolved issues	**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 (NTS 1a, 3i). 4.2 Engage tutors to identify unresolved issues relating to this lesson for clarification	**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	**5 mins**

	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* **Advance Preparation** 4.3 Ask tutors to read Lesson 8 of the Course Manual on: **Early Grade** - Handling Data and Chance: *(Teaching and Assessing* **Upper Primary** - Handling Data and Chance: *(Teaching and Assessing)* **JHS-** Handling Data and Chance: *(Teaching and Assessing)* **JHS Calculus** -Integration 2: Learning and applying N/B *XVI. Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* *XVII. Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to this lesson for clarification.* *XVIII. Collect all 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*	**Advance Preparation** 4.3 Read Lesson 8 of the Course Manual on: **Early Grade** - Handling Data and Chance: *(Teaching and Assessing* **Upper Primary** - Handling Data and Chance: *(Teaching and Assessing)* **JHS-** Handling Data and Chance: *(Teaching and Assessing)* **JHS Calculus** -Integration 2: Learning and applying N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	

	be used to support the achievement of your goals		
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring: subject project, subject portfolio preparation and development are explicitly addressed in the PD sessions.			

Age Phase/s:

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

Name of Subject/s:

a. Mathematics: Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Teaching and Assessing JHS
d. Mathematics – Calculus

Tutor PD Session for Lesson 8 in the Course Manual

Lesson Tittle:

a. Early Grade - Handling Data and Chance
b. Upper Grade - Handling Data and Chance
c. JHS (CORE) - Handling Data and Chance
d. JHS (SP) - Integration 2

Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction / lesson overview • Overview of subject/s age phase/s to be covered in this PD session and how it will be organised. Including guidance on grouping tutors according to the subject/s, age phase/s. • Reflection on previous PD Session (Introduction to the course manual/s) • Introduction and overview of the main purpose of the lesson in the course manual/s • Identification of important or distinctive aspects of the lesson/s	**Introduction** 1.1 Ice breaker activity: Begin by asking members to take turns to say as many things as possible about the Mathematics Department of the College. Skip a member who delays his/her turn. 1.2 Ask tutors to tell how useful the previous PD session was and how it influenced their teaching over the week and how students were well placed to employ the various concepts and skills during STS field experience. 1.3 Ask a critical friend to give feedback on his/her observation of the last enacted lesson for the whole group to deliberate.	**Introduction** 1.1 In turns, quickly say as many things as possible about the Mathematics Department of the College. 1.2 Tell how useful the previous PD session was and how it influenced your teaching over the week and how students were well placed to employ the various concepts and skills during STS field experience. 1.3 As a critical friend, give feedback on your observation of the previous enacted lesson.	

• Reading and discussion of the introductory sections up to learning outcomes	N/B: Draw tutors' attention to all NTS references. 1.4 Lead tutors to discuss any challenges that arose during the enactment of the previous lesson and how they were resolve. Eg. In what ways did the students appreciate the need to consider equality and equity during the lesson and during STS activities? 1.5 Ask tutors to read the course manual and identify the purpose and learning outcomes of the lesson for the day. Ask members to state their expectations of the PD Session on lesson 8. NTS 2b 1.6 Lead tutors in pairs to discuss the important or distinctive aspects of lesson 8 such as vocabulary and fundamental concepts related to the lesson including GESI and ICT issues. ***Distinctive aspects*** *include the interactive nature of the activities, emphasizing on connecting concepts:* *a. Early Grade– eg. Collect, interpret and present data and chance.* *b. Upper Grade – eg. Measures of central tendencies, Graphical representation and chance.* *c. JHS; Assessment – eg. Measures of central tendencies, Graphical representation and chance.*	N/B: Pay attention to all NTS references. 1.4 Discuss any challenges that arose during the enactment of the previous lesson and how they were resolve. 1.5 Read the course manual to identify the purpose of the lesson (NTS 2b) and state your expectations of the PD Session 1.6 In pairs, discuss the important or distinctive aspects of lesson 8 such as vocabulary and fundamental concepts related to the lesson including GESI and ICT issues.	

	d. JHS; Calculus – eg. Numerical Integration and its Applications 1.7 Ask tutors to read individually and discuss in pairs the introductory sections of the lesson (up to Learning Outcomes). N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *ii. Which graphical representations should be treated in this semester?* *iii. What should be done to complete the lesson since the scope is wide?*	1.7 Read individually and discuss the introductory sections of the lesson (up to Learning Outcomes).	
The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which might arise from the introduction to the lesson and provide responses for SL/HoD.* • *Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD*			

2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. • Identification of needed resources for the teaching and learning of the concept.	**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. Refer to BSC B1.4.1.1, B1.4.1.2, B2.4.1.1., B2.4.1.2 B3.4.1.1, B3.4.1.2 B4.4.1.1, B4.4.1.2, B6.4.1.1-2, B6.4.2.2 2.3 Using think-pair-share, ask tutors to outline possible challenging areas in teaching and assessing Handling Data and Chance (in EGE, UPE, JHS Core) and Integration 2 in JHS (SP). Take into consideration GESI (eg. Use motivating statements for all manner of students) 2.4 Ask tutors to suggest creative approaches for addressing the identified challenges. Eg. Using group work, the principle of multiple embodiments, problem solving, internet search. 2.5 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. Example: a. Early/Upper/JHS (Core) Grade – "Age is a discrete variable"	**Concept Development** 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. Refer to BSC B1.4.1.1, B1.4.1.2, B2.4.1.1., B2.4.1.2 B3.4.1.1, B3.4.1.2 B4.4.1.1, B4.4.1.2, B6.4.1.1-2, B6.4.2.2 2.3 Draw Kk Through think-pair-share, outline possible challenging areas in teaching and assessing Handling Data and Chance (in EGE, UPE, JHS Core) and Integration 2 in JHS (SP). Take into consideration GESI. 2.4 Discuss misconceptions and barriers in teaching and learning of the lesson. 2.5 Identify GESI responsive resources that can be used to achieve the LOs.	**25 mins**

	b. JHS (Calculus) – "Integration cannot be applied in everyday life activity". ***Barrier:*** *Appropriate inclusive resources Technology* *Pre-requisite knowledge* 2.6 Focusing on one Phase at a time, ask tutors to identify GESI responsive resources that can be used to achieve the LOs. *N/B: Such resources include supporting staff for sign language, projectors, flip charts, sticky notes, tactile that can be used in the teaching and learning of the concepts mentioned above. other materials are ludu dice, graph sheets, news prints, exams score sheets and curriculum materials) NTS 3j*	2.6 Identify GESI responsive resources that can be used to achieve the LOs.	
Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be considered prior to taking tutors through the lesson activities "walk through".* • *The resources needed must be identified: literature – page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability*			

• *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification • Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course assessment: subject project (30%), subject portfolio (30%) and end of semester examination (40%) • Working through one or two activities,	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities useful for achieving the learning outcomes of the lesson taking into account GESI. eg. i. Provision made for physically challenged during grouping ii. Both genders take leading roles in group task iii. Even distribution of questions NTS 1a, b, c, d, 2b, e, f, 3b, c, BSC p. iii) 3.2 Ask tutors to read the activities outlined in the course manual and identify areas that require clarification. ***N/B:*** *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.* 3.3 Lead tutors through brainstorming 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.	**Teaching and learning activities** 3.1 Suggest teaching and learning activities useful for achieving the learning outcomes of the lesson taking into account GESI. 3.2 Read the activities outlined in the 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.	**40 mins**

	Example: *Group Work - Collaborative learning* *Investigation - Critical Thinking* *Role Play - Communication* *Students can ascertain the extent to which methods are used during STS activities in schools.*		
	3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson – 'Assessment as' (NTS 3k) and group work presentation. ***N/B:*** *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) and group work presentation.	
	3.5 Lead tutors to discuss the various ways they can support student teachers to build their project and portfolio before/during/ after lessons.	3.5 Discuss the various ways they can support student teachers to build their portfolio	
	3.6 Ask a tutor to model a presentation of an activity using ICT tools and taking into consideration GESI issues (eg. Allowing students to demonstrate the use of ICT tools and ensuring both gender take the leading roles in their groups. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	
	3.7 With the help of a Lesson Observation Guide, lead	3.7 With the help of Lesson Observation Guide,	

	tutors to reflect on the modelled lesson	reflect on the modelled lesson	
Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course assessment components* • *The selected activities should be done with tutors in real or close to real time* • *Anticipate any issues for clarification or questions which might arise as the tutors work through the activities and provide guidance on these* • *Identify where, and which, core and transferable skills, including 21st skills and the use of*			

information technology, are being developed or applied • *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide guidance on development of these*			
4. Evaluation and review of session: • identification of any outstanding issues relating to this lesson for clarification • Advance preparation In the case of unresolved issues	**Evaluation and review of session:** 4.1 Encourage tutors to provide feedback of the PD session taking into consideration inclusivity – how to be patient with stutterers, using tactile for the visually challenged, allowing tutors to show by fingers/nods. (NTS 1a, 3i). 4.2 Ask tutors to read Lesson 9 of the Course Manual before the next PD session. **Early Grade** - Rational and Irrational Number 1 (Teaching and Assessing)	**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 Read the next lesson (Lesson 9) of the Course Manual on: **Early Grade** - Rational and Irrational Number 1 (Teaching and Assessing)	**5 mins**

	Upper Primary - Rational and Irrational Number 1 (Teaching and Assessing) **JHS(Core)** - Rational and Irrational numbers 1 (Teaching and Assessing 2) **JHS Calculus** - Integration 2: Learning and applying 4.3 Ask tutors to come out with unresolved issues relating to this lesson for clarification. ***N/B:*** *Take note of all unresolved issues and use any of following strategies* – *put on SL WhatsApp platform for discussion* – *tutors to research for the next PD session for discussion* N/B *XIX. Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* *XX. 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 rehearse how these may be used to support the achievement of your goals*	**Upper Primary** - Rational and Irrational Number 1 (Teaching and Assessing) **JHS(Core)** - Rational and Irrational numbers 1: Teaching and Assessing **JHS Calculus** - Integration 2: Learning and applying 4.3 Reflect on the activities in the session and outline unresolved issues relating to the lesson N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	

Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring: subject project, subject portfolio preparation and development are explicitly addressed in the PD sessions.	

Age Phase/s:
a. Early Grade
b. Upper Grade
c. JHS (Core)
d. JHS (Maths Sp)

Name of Subject/s:
a. Mathematics: Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Mathematics: Teaching and Assessing JHS
d. Mathematics – Learning and Applying in Calculus

Tutor PD Session for Lesson 9 in the Course Manual

Lesson Title:
a. **Early Grade:** Rational and Irrational Number 1
b. **Upper Grade:** Rational and Irrational Number 1
c. **JHS (Core):** Rational and Irrational Number 1
d. **JHS (Maths Sp):** Learning and Applying Integration 2

Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction • Overview of subject/s age phase/s to be covered in this PD session and how it will be organised. Including guidance on grouping tutors according to the subject/s, age phase/s.	**Introduction** 1.1 Ice breaker activity: Provide each tutor with a pack of task cards for them to pick and act on the questions Examples: ○ What is the title of a favourite book? ○ Spell Calculus with your head? ○ Mention in sequence four real number systems. 1.2 Ask tutors to tell how useful the PD session 8 was and how it influenced their teaching in semester one. (NTS 1b)	**Introduction** 1.1 Pick and act on the questions 1.2 How useful was the previous PD session and how did it influence your teaching over the week?	

• Reflection on previous PD Session (Introduction to the course manual/s) • Introduction and overview of the main purpose of the lesson in the course manual/s	N/B: Draw tutors' attention to all NTS references. 1.3 Ask tutors to identify the purpose of the lesson from the course manual and state their expectations of the PD Session 1.4 Ask tutors to read the overview of the courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in phase groups where applicable. 1.5 Guide tutors to establish the relationship between CLOs and the learning outcomes of individual lessons in the course. 1.6 Ask tutors in phase groups to discuss the important or distinctive aspects of the first lesson including vocabulary and fundamental concepts related to the components of the front matters. ***Distinctive aspects*** *include the interactive nature of the activities, emphasis on connecting concepts:* *a. Early Grade: eg. relationships among the various aspects of real number system* *b. Upper Grade: eg. application of real number system to real life*	N/B: Pay attention to all NTS references. 1.3 Identify the purpose of the lesson from the course manual and state your expectations of the PD Session. 1.4 Read the overview of the lesson and discuss the course learning outcomes (CLOs) in groups as appropriate. 1.5 Guide tutors to establish the relationship between CLOs and the learning outcomes of individual lessons in the course. 1.6 In phase groups, discuss the distinctive aspects of the first lesson including vocabulary and fundamental concepts related to the components of the front matters.	

• Identification of important or distinctive aspects of the lesson • Reading and discussion of the introductory sections up to learning outcomes	*c. JHS (Core): eg. application of real number system to real life* *d. JHS; Calculus: apply fundamental ideas of integration with emphasis on numerical Integration and application of Integration.* 1.7 Ask tutors to read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson. N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *i. How do we perform trigonometric rules for integration process?* *ii. What are the examples of irrational numbers?*	1.7 Read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson.	
The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which might arise from the introduction to the lesson and provide responses for SL/HoD.*			

Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD			
2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. This may include GESI and ICT related concepts. • Identification of some misconception and barriers in teaching and learning the concept.	**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. 2.3 Ask tutors to outline possible challenging areas in Teaching and Assessing rational and irrational numbers 1 and Integration 2 in Calculus taking into consideration GESI such as giving equal opportunity for all to solve task irrespective gender, physical or social challenge. **N/B:** *The challenging areas include application of numerical integration* 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. Example: *a. Early/ Upper/ JHS (CORE) Grade – that ∏ is a rational number.* *d. JHS (Calculus) – integrating by partial fractions*	**Concept Development** 2.1 Identify familiar and unfamiliar concepts in your lesson and discuss with the larger group. 2.2 Draw connections among concepts in the lesson in line with the basic school curriculum. 2.3 Outline possible challenging areas in Teaching and Assessing rational and irrational numbers 1, Learning and Applying Integration 2 taking into consideration GESI. 2.4 Discuss the misconceptions and barriers in teaching and learning of the lesson.	**25 mins**

• Identification of needed GESI responsive and ICT resources for the teaching and learning of the concept.	Ask tutors to suggest 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, graph sheet, mathematical set, projectors, flip charts, sticky notes, tactile, posters; video clips; downloads; models etc. materials that can be used in the teaching and learning of the concepts mentioned above (NTS 3j).	Identify as many GESI responsive resources such as supporting staff with experts in sign language as well as resources such as resource persons and material resources that can be used in the teaching and learning of the concepts in the lesson (NTS 3j).	
Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be considered prior to taking tutors through the lesson activities "walk through".* • *The resources needed must be identified: literature – page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability* *This section can build on the PD needs identified from the course manuals*			

<table>
<tr>
<td>3. Teaching, learning and assessment activities for the lesson
• Reading of teaching and learning activities and identification of areas that require clarification</td>
<td>Teaching and learning activities
3.1 Ask tutors to suggest teaching and learning activities for the lesson taking into account GESI issues and demonstrate how the LO's and LI's of the curriculum can be achieved.
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 Ask tutors to read the activities outlined in the course manual and identify areas that require clarification.
Strategies and techniques 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.
<table>
<tr><th>Strategy</th><th>Core Competency</th></tr>
<tr><td>Group Work</td><td>Collaborative learning</td></tr>
<tr><td>Investigation</td><td>Critical Thinking</td></tr>
<tr><td>Role Play</td><td>Communication</td></tr>
</table>
</td>
<td>Teaching and learning activities
3.1 Suggest teaching and learning activities for the lesson taking into account GESI issues and demonstrate achievement of LO's and LI's in the curriculum

3.2 Read the activities outlined in the 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.</td>
<td>40 mins</td>
</tr>
</table>

• Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course assessment: subject project (30%), subject portfolio (30%) and end of semester examination (40%) Working through one or two activities,	3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson – 'Assessment as' (NTS 3k), Encourage tutors to discuss the mode of Assessment (working in group or individual by presentation, exercises, project etc) *Assessment must be aligned to the NTEAP and required course Assessment* 3.5 Lead tutors to discuss the various ways they can support student teachers to build their portfolio. 3.6 Ask a tutor to 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). NTS 1a, b, 2b, e, 3b, c, J; BSC. 3.7 Lead tutors to discuss how student teachers can apply the pedagogy developed in the lesson during STS activities in basic schools. NB *Tutors are likely to ask about the relevance of this activity in teaching mathematics lessons. When this comes up, refer them to PD Manuals:* *i. that is, Creative Approaches*	3.4 Discuss the assessment strategies to be used during teaching of the lesson – 'Assessment as' (NTS 3k). Discuss the mode of Assessment. 3.5 Discuss the various ways they can support student teachers to build their portfolio. 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. 3.7 Discuss how student teachers can apply the pedagogy developed in the lesson during STS activities in basic schools.	

	ii. the core and transferable skills being developed or used include social skills, communication skills, critical and creative thinking skills *iii. creative Activities, Questioning, Talk and Learn and Group Work can be used to support the delivery of this session.*		
Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course assessment components* • *The selected activities should be done with tutors in real or close to real time* • *Anticipate any issues for clarification or questions which might arise as the tutors work through the activities and*			

provide guidance on these • *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied* • *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide guidance on development of these*			
4. Evaluation and Review of session: • identification of any outstanding issues relating to this lesson for clarification	**Reflective Activity** 4.1 Encourage tutors to provide feedback of the PD session taking into consideration inclusivity – how to be patient with stutterers, using tactile for the visually challenged, allowing tutors to show by fingers/nods. (NTS 1a, 3i).	**Reflective Activity** 4.1 Share your experience in the PD session. 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.	**5 mins**

	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.	4.2 Reflect on the activities in the session and outline unresolved issues relating to the lesson.	
	4.3 Ask tutors in pairs to mention how GESI issues were used in the lesson.	4.3 Mention how GESI issues was used in the lesson	
In the case of unresolved issues	4.4 Lead tutors to discuss the strategies required to resolve the unresolve issues identified.	4.4 Discuss the strategies you will use to resolve the unresolved issues	
• Advance Preparation	NB *Take note of all unresolved issues and use any of following strategies* *i. put on SL/SWL WhatsApp, Telegram platform for discussion.* *ii. tutors to research for the next PD session for discussion*		
	Advance Preparation 4.5 Ask tutors to read Lesson 10 of the Course Manual on: **a. Early Grade:** Fractions 1 **b. Upper Grade:** Handling Data 1 (Teaching and Assessing) **c. JHS (Core):** Fractions 1 (Teaching and Assessing) **d. JHS (Maths Sp):** Numerical Integration: Learning and applying	**Advance Preparation** 4.5 Read Lesson 10 of the Course Manual on: **a. Early Grade:** Fractions 1 **b. Upper Grade:** Handling Data 1 (Teaching and Assessing) **c. JHS (Core):** Fractions 1 (Teaching and Assessing) **d. JHS (Maths Sp):** Numerical Integration: Learning and applying	
	N/B *i. Remind tutors to identify a critical friend from the*	N/B *Get a critical friend from the same or related discipline to*	

	same or related discipline to observe during teaching and provide feedback (NTS 1a). *ii. Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to this lesson for clarification.* *iii. Collect all 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*	*observe your lesson during teaching and provide feedback (NTS 1a).*	
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring: subject project, subject portfolio preparation and development are explicitly addressed in the PD sessions.			

Age Phase/s:

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

Name of Subject/s:

a. Mathematics: Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Teaching and Assessing JHS
d. Mathematics – Calculus

Tutor PD Session for Lesson 10 in the Course Manual

Lesson Title:
a. Early Grade: Fractions 1
b. Upper Grade: Handling Data 1 (Teaching and Assessing)
c. JHS (Core): Fractions 1 (Teaching and Assessing)
d. JHS (Maths Sp): Numerical Integration: Learning and applying

Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction / lesson overview • Overview of subject/s age phase/s to be covered in this PD session and how it will be organised. Including guidance on grouping tutors according to the subject/s, age phase/s. • Reflection on previous PD Session (Introduction to the course manual/s) • Introduction and overview of the main purpose of the lesson in the course manual/s	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity according to the subjects and age phases (e.g. JHS (core): select some fraction (say $\frac{1}{2}, \frac{2}{5}\ and\ \frac{7}{3}$) to let tutors name them. Pay attention to the exposition for the correct naming of fractions such as one-half for $\frac{1}{2}$, two-fifths for $\frac{2}{5}$ and seven-third $\frac{7}{3}$. **Calculus**: using a card board cut out a trapezium with some specified size and find its area and try to approximate to definite integrals.)	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity (e.g. JHS (core): select some fraction (say $\frac{1}{2}, \frac{2}{5}\ and\ \frac{7}{3}$) to let tutors name them. Pay attention to the exposition for the correct naming of fractions such as one-half for $\frac{1}{2}$, two-fifths for $\frac{2}{5}$ and seven-third $\frac{7}{3}$. **Calculus**: using a card board cut out a trapezium with some specified size and find its area and try to approximate to definite integrals.)	

• Identification of important or distinctive aspects of the lesson/s • Reading and discussion of the introductory sections up to learning outcomes	1.2 Expose tutors to the overview of the subject age phases to be covered in this PD session and how it will be organised. v. ***Early and JHS (Core)*** *lessons focus on developing an understanding of Teaching and assessing early and JHS (core) Mathematics especially, fractions and its application within the basic school curriculum**.*** vi. ***Upper primary*** focuses *on developing an understanding of Teaching and Assessing Primary School Mathematics about handling data. The topics to be considered include Collecting, interpreting and presenting data* vii. ***JHS (Maths Sp)*** *lesson seeks to develop student teachers' content knowledge and experiences to establish and address their learning needs, perceptions and misconceptions of concepts based on differentiation. The areas to be covered include the definition of derivatives (algebraic properties of derivatives- sum, difference, product, quotient), as well as, derivatives of polynomial and rational. Special attention will be given to continuity of polynomial and rational functions.* 1.3 Ask a critical friend to give feedback on observation	1.2 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.	

	during the enactment of lesson 9. N/B: Draw tutors' attention to all NTS references. 1.4 Ask tutors to tell how useful the previous PD session was and how it influenced their teaching over the week. 1.5 Ask tutors to suggest the purpose of the lesson and state their expectations of the PD Session. 1.6 Ask tutors to read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate 1.7 Guide tutors to establish the linkage between CLOs and the LOs of the lesson 1.8 Ask tutors in pairs discuss the important or distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters. ***Distinctive aspects*** *include the interactive nature of the activities with emphasis on connecting concepts (creating addition facts, Effective assessment skills, key features of the basic school curriculum, applying a topic to real life* with *other lessons and the use of relevant resources*.	1.3 As a critical friend, share with members feedback on observation during the teaching of lesson 9. 1.4 Explain how useful the previous PD session influenced their teaching over the week. 1.5 Engage tutors to suggest the purpose of the lesson and state your expectations of the PD Session. 1.6 Read the overview of the various courses (of the various phases) and discuss the course learning outcomes (CLOs) in groups as appropriate 1.7 Participate in the identification of the CLOs and link them to the LOs of the lesson 1.8 In pairs discuss the distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters.	

	a. Early Grade– eg. The use of TLM to assist student teachers to prepare and identify innovative ways of teaching mathematics, especially, fractions to Early Grade learners. *b. Upper Grade – eg. the use of TLMs and ICT to aid student teachers to prepare and model interactive, and innovative ways of teaching mathematics, especially, collecting and handling data* *c. JHS (core) – eg. The use of manipulatives, ICT tools, and other TLMs to establish mathematical principles based on addition and subtraction of fractions* *d. JHS (Math sp) – eg. application of integration to finding areas and volumes in real life situations* 1.9 Ask tutors to read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson. N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *viii. How can an assessment strategy be infused into the learning process of operations on fractions?* *ix. How can the Trapezium and Simpson's rules be*	1.9 Read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lesson.	

	linked to definite integrals?		
The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which might arise from the introduction to the lesson and provide responses for SL/HoD.* • *Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD*			
2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. • Identification of needed resources for the teaching	**Concept Development** 2.1 Lead tutors to identify familiar and unfamiliar concepts in the lesson and discuss connections among concepts in the lesson. 2.2 Engage tutors to identify and discuss various strategies for the development of conceptual understanding of the lesson.	**Concept Development** 2.1 Identify familiar and unfamiliar concepts in the lesson and discuss connections among concepts in the lesson. 2.2 Identify and discuss various strategies for the development of conceptual understanding of a. Early Grade – operations on fractions b. Upper Grade – Handling of data	**25 mins**

and learning of the concept.	<table><tr><th>Level</th><th>Concept</th><th>Strategy</th></tr><tr><td>Early Child</td><td>Fractions 1</td><td>Interactive</td></tr><tr><td>Upp Grade</td><td>Handling data</td><td>Model lessons/ Internet search</td></tr><tr><td>JHS(Core)</td><td>Fractions 1(Teaching and assessing)</td><td>Interactive and Model lessons</td></tr><tr><td>JHS(sp)</td><td>Trapezium and Simpsons rules and Definite integrals</td><td>Model lesson</td></tr></table> 2.3 Ask tutors to outline possible challenging areas in the teaching and assessing fractions and handling data and the link between the area of regular shapes and definite integrals taking into consideration GESI 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 and creating a safe, secure, happy and stimulating learning environment (NTS 3f, pg. 14) .* 2.4 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lesson. Eg a. Early Grade – all fractions are always part of 1 and never greater than 1, b. Upper Grade - c. JHS (CORE) – Fractions are rational numbers. d. JHS (Math sp) – Calculus is for gifted children	c. JHS (core)- rational numbers and fractions d. JHS (sp)-link between trapezium and Simpson's roles and definite integrals. 2.3 Outline possible challenging areas in the teaching and assessing fractions and handling data and the link between the area of regular shapes and definite integrals taking into consideration GESI **GESI**. 2.4 Participate 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 for sign language, projectors, flip charts, sticky notes, tactile that can be used in the teaching and learning of the concepts mentioned above (e.g. curriculum materials, teachers and leaners resource packs, textbooks, course manual, etc.) NTS 3j *i. Need to identify any aspect of the lesson that might be challenging for tutors in terms of new learning which need to be considered prior to taking tutors through the lessons.* *ii. Need to identify needed resources well suited for each lesson according to the subject and age phase: where appropriate, indicate the literature page referenced etc., on web, Youtube, powerpoint, physical resources*	2.5 Identify as many GESI responsive resources as possible that can be used in the teaching and learning of the concepts in teaching and assessment of operations on fractions and exploring concepts of limit and derivatives of a function NTS 3j	
Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be considered prior to taking tutors through the lesson activities " walk through".* • *The resources needed must be*			

identified: literature – page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification • Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course assessment: subject project (30%), subject portfolio (30%) and end of semester examination (40%) • Working through one or two activities,	**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 Ref: Writing the weekly PD session-pp 3., NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Let tutors read the activities outlined in the course manual 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	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson taking into account GESI issues. 3.2 Read the activities outlined in the 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	**40 mins**

	for that matter basic school learners. eg. **Strategy** / **Core Competency** Group Work / Collaborative learning Investigation / Critical Thinking Role Play / Communication 3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson. (NTS 3k). *Assessment must be aligned to the NTEAP and required course Assessment to include subject project (30%), subject portfolio (30%) and end of semester examination (40%)* 3.5 Lead tutors to discuss the various ways they can support student teachers to build their portfolio and subject projects. 3.6 Ask tutors to 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) in the lesson; shapes, space and measurement (Teaching and Assessing) and integration. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii) Note *i. Select activities, linked to CLO and indicators, from the lesson that are likely to*	and for that matter basic school learners. 3.4 Engage tutors to discuss the assessment strategies to be used during teaching of the lesson (NTS 3k). 3.5 Engage tutors to discuss the various ways they can support student teachers to build their portfolio 3.6 Engage tutors to model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons; shapes, space and measurement (Teaching and Assessing) and integration. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	

	be most different from tutors *ii. The selected activities should be done with tutors in real or close to real time* *iii. Identify where, and which, core and transferable skills, including 21st skills and the use of information skills*		
Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course assessment components* • *The selected activities should be done with tutors in real or close to real time* • *Anticipate any issues for clarification or questions which might arise as the tutors work through the*			

activities and provide guidance on these • *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied* • *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide guidance on development of these*			
4. Evaluation and review of session: • identification of any outstanding issues relating to this lesson for clarification • Advance preparation	**Reflective Activity** 4.1 Ask tutors to identify the assessment components of the lesson in the new course manual focusing on Assessment of, as and for to reflect the demands of the NTEAP in a. Early Grade – Lesson 10.	**Reflective Activity** 4.1 Engage the tutors to identify the assessment components of the lesson in the new course manual focusing on assessment of, as and for to reflect the demands of the NTEAP in	**5 mins**

• In the case of unresolved issues	b. Upper Grade – Lesson 10 c. JHS; Assessment – Lesson 10 d. JHS; Euclidean – Lesson 10 4.2 Ask tutors to show by fingers/nods their level of satisfaction with the session. (NTS 1a, 3i). 4.3 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* 4.4 Lead tutors to discuss the various ways they can support student teachers to build their portfolio **Advance Preparation** 4.5 Ask tutors to read Lesson 11 of the Course Manual on: **Early Grade** - Fraction 2 **Upper Primary** - Handling Data 2 **JHS (core)-** Fraction 2 **JHS (sp)** – Application of Integration: Learning and applying	a. Early Grade – Lesson 10. b. Upper Grade – Lesson 10 c. JHS; Assessment – Lesson 10 d. JHS; Euclidean – Lesson 10 4.2 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. 4.3 Reflect on the activities in the session and outline unresolved issues relating to the lesson 4.4 Discuss the various ways they can support student teachers to build their portfolio **Advance Preparation** 4.5 Read Lesson 11 of the Course Manual on: **Early Grade** - Fraction 2 **Upper Primary** - Handling Data 2 **JHS (core)-** Fraction 2 **JHS (sp)** – Application of Integration: Learning and applying	

	N/B a. *Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* b. *Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to this lesson for clarification.* c. *Collect all 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*	N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring: subject project, subject portfolio preparation and development are explicitly addressed in the PD sessions.			

Age Phase/s:

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

Name of Subject/s:

a. Mathematics: Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Teaching and Assessing JHS
d. Mathematics – Calculus

Tutor PD Session for Lesson 11 in the Course Manual

Lesson Tittle:

a. Early Grade - Fractions 2
b. Upper Grade - Fractions 2
c. JHS (CORE) - Fractions 2
d. JHS (SP) - Applications of integration: Learning and applying

Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction / lesson overview • Overview of subject/s age phase/s to be covered in this PD session and how it will be organised. Including guidance on grouping tutors according to the subject/s, age phase/s. • Reflection on previous PD Session (Introduction to the course manual/s) • Introduction and overview of the main purpose of the lesson in the course manual/s	**Introduction** 1.1 Ice breaker 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? 1.2 Ask tutors to tell how useful the previous PD session was and how it influenced their teaching over the week and how students were well placed to employ the various concepts and skills during STS field experience. 1.3 Ask a critical friend to give feedback on his/her observation of the last	**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? 1.2 Tell how useful the previous PD session was and how it influenced your teaching over the week and how students were well placed to employ the various concepts and skills during STS field experience. 1.3 As a critical friend, give feedback on your	

• Identification of important or distinctive aspects of the lesson/s • Reading and discussion of the introductory sections up to learning outcomes	enacted lesson for the whole group to deliberate. N/B: Draw tutors' attention to all NTS references. 1.4 Lead tutors to discuss any challenges that arose during the enactment of the previous lesson and how they were resolved. Eg. In what ways did the students appreciate the need to consider equality and equity during the lesson and during STS activities? 1.5 Ask tutors to read the course manual and identify the purpose and learning outcomes of the lesson for the day. Ask members to state their expectations of the PD Session on lesson 11. NTS 2b. 1.6 Lead tutors in pairs to discuss the important or distinctive aspects of lesson 11 such as vocabulary and fundamental concepts related to the lesson including GESI and ICT issues. ***Distinctive aspects*** *include the interactive nature of the activities, emphasizing on connecting concepts:* *a. Early Grade– eg. Multiplication and division of fractions and* connecting *common and decimal fractions and percent*.	observation of the previous enacted lesson. N/B: Pay attention to all NTS references. 1.4 Discuss any challenges that arose during the enactment of the previous lesson and how they were resolved. 1.5 Read the course manual and identify the purpose of the lesson (NTS 2b) and state your expectations of the PD Session. 1.6 In pairs, discuss the important or distinctive aspects of lesson 11 such as vocabulary and fundamental concepts related to the lesson including GESI and ICT issues.	

	b. Upper Grade– eg. Multiplication and division of fractions and connecting *common and decimal fractions and percent*. *c. JHS (Core) – eg. Multiplication and division of fractions and* connecting *common and decimal fractions and percent*. *d. JHS; Calculus – eg. Areas under curves and volumes of solids of revolution* 1.7 Ask tutors to read individually and discuss in the whole group introductory sections of the lesson (up to Learning Outcomes). N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *iv. In what everyday life situation can the connections between common fractions, decimals and percentages be seen?* *v. What formular will be used for the area under the curve?*	1.7 Read individually and discuss the introductory sections of the lesson in the whole group (up to Learning Outcomes).	
The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which*			

might arise from the introduction to the lesson and provide responses for SL/HoD. • *Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD*			
2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. • Identification of needed resources for the teaching and learning of the concept.	**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. Refer to B.ED course manual and BSC B1.1.3.1, B2.1.3.1, B3.1.3.1, B4.1.3.1, B5.1.3.1, B6.1.3.1 2.3 Using think-pair-share, ask tutors to outline possible challenging areas in teaching and assessing fractions (in EGE, UPE, JHS Core) and Applications of integration in JHS (SP). Take into consideration GESI (eg. Use motivating statements for all manner of students) 2.4 Ask tutors to suggest creative approaches for	**Concept Development** 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 B.ED course manual in line with the basic school curriculum. Refer to BSC B1.1.3.1, B2.1.3.1, B3.1.3.1, B4.1.3.1, B5.1.3.1, B6.1.3.1 2.3 Through think-pair-share, outline possible challenging areas in teaching and assessing Fractions (in EGE, UPE, JHS Core) and Applications of integration in JHS (SP). Take into consideration GESI. 2.4 Mention creative approaches for addressing the identified challenges.	**25 mins**

	addressing the identified challenges. Eg. Using group work, the principle of multiple embodiment, problem solving, internet search. 2.5 Lead tutors to discuss barriers and misconceptions in teaching and learning of the lesson. Example: a. Early/Upper/JHS (Core) Grade – "To multiply a whole number by a fraction, we multiply the whole number by both the numerator and the denominator" b. JHS (Calculus) – "Integration cannot be applied in everyday life activity". ***Barrier:*** *Appropriate inclusive resources* *Technology* *Pre-requisite knowledge* 2.6 Focusing on one Phase at a time, ask tutors to identify GESI responsive resources that can be used to achieve the LOs. *N/B: Such resources include supporting staff for sign language, projectors, flip charts, sticky notes, tactile that can be used in the teaching and learning of the concepts mentioned above. other materials are ludu dice, graph sheets, news prints, exams score sheets and curriculum materials) NTS 3j*	2.5 Discuss barriers and misconceptions in teaching and learning of the lesson. 2.6 Identify GESI responsive resources that can be used to achieve the LOs.	

Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be considered prior to taking tutors through the lesson activities " walk through".* • *The resources needed must be identified: literature – page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability* *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification • Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities useful for achieving the learning outcomes of the lesson taking into account GESI. eg. *i.* Provision made for physically challenged during grouping *ii.* Both genders take leading roles in group task *iii.* Even distribution of questions NTS 1a, b, c, d, 2b, e, f, 3b, c, BSC p. iii)	**Teaching and learning activities** 3.1 Suggest teaching and learning activities useful for achieving the learning outcomes of the lesson taking into account GESI.	**40 mins**

assessment: subject project (30%), subject portfolio (30%) and end of semester examination (40%) • Working through one or two activities,	3.2 Ask tutors to read the activities outlined in the course manual and identify areas that require clarification. ***N/B:*** *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.* 3.3 Lead tutors through brainstorming 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. *Example:* *Group Work - Collaborative learning* *Investigation - Critical Thinking* *Role Play - Communication* *Students can ascertain the extent to which methods are used during STS activities in schools.* 3.4 Ask tutors to discuss the assessment strategies to be used during teaching of the lesson – 'Assessment as' (NTS 3k) and group work presentation. ***N/B:*** *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*	3.2 Read the activities outlined in the 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 lesson – 'Assessment as' (NTS 3k) and group work presentation.	

	3.5 Lead tutors to discuss the various ways they can support student teachers to build their project and portfolio before, during and after lessons. 3.6 Ask a tutor to model a presentation of an activity using ICT tools and taking into consideration GESI issues (eg. Allowing students to demonstrate the use of ICT tools and ensuring both gender take the leading roles in their groups) NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii 3.7 With the help of a Lesson Observation Guide, lead tutors to reflect on the modelled lesson	3.5 Discuss the various ways they can support student teachers to build their portfolio 3.6 Model a presentation of an activity using ICT tools and taking into consideration GESI issues. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii 3.7 With the help of Lesson Observation Guide, reflect on the modelled lesson	
Guidance notes for SL/HoD should • *Select activities, linked to CLO and indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches* • *Identify how any assessments relate to course*			

assessment components • *The selected activities should be done with tutors in real or close to real time* • *Anticipate any issues for clarification or questions which might arise as the tutors work through the activities and provide guidance on these* • *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied* • *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance*			

• *Identify resources required for any TLMs and provide guidance on development of these*			
4. Evaluation and review of session: • identification of any outstanding issues relating to this lesson for clarification • Advance preparation • In the case of unresolved issues	**Evaluation and review of session:** 4.1 Encourage tutors to provide feedback of the PD session taking into consideration inclusivity – how to be patient with stutterers, using tactile for the visually challenged, allowing tutors to show by fingers/nods. (NTS 1a, 3i). 4.2 Ask tutors to come out with unresolved issues relating to this lesson for clarification. ***N/B:*** *Take note of all unresolved issues and use any of following strategies* – *put on SL WhatsApp platform for discussion* – *tutors to research for the next PD session for discussion* 4.3 Ask tutors to read Lesson 12 of the Course Manual before the next PD session. **Early Grade** - End of Semester Review (Lessons 1-11) **Upper Primary** - End of Semester Review (Lessons 1-11) **JHS(Core)** - End of Semester Review (Lessons 1-11)	**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 4.3 Read the next lesson (Lesson 12) of the Course Manual on: **Early Grade** - End of Semester Review (Lessons 1-11) **Upper Primary** - End of Semester Review (Lessons 1-11) **JHS(Core)** - End of Semester Review (Lessons 1-11) **JHS Calculus** - Applications of integration 2: Learning and applying	5 mins

	JHS Calculus - Applications of integration 2: Learning and applying N/B *XXI. Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* *XXII. Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to the lesson for clarification.* *XXIII. 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*	N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring: subject project, subject portfolio preparation and development are			

explicitly addressed in the PD sessions.	

Age Phase/s:

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

Name of Subject/s:

a. Mathematics: Teaching and Assessing
b. Mathematics: Teaching and Assessing
c. Teaching and Assessing JHS
d. Mathematics – Calculus

Tutor PD Session for Lesson 12 in the Course Manual

Lesson Title: **a. Early Grade:** Revision of Mathematics: Teaching and Assessing **b. Upper Grade:** Revision of Mathematics: Teaching and Assessing **c. JHS (Core):** Revision of Teaching and Assessing **d. JHS (Maths Sp):** Revision of calculus			
Focus: the bullet points provide the frame for what is to be done. The guidance notes in italics identify the prompt the SL/HoD needs and each one must be addressed	**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 state of the session)	**Time in session**
1. Introduction / lesson overview • Overview of subject/s age phase/s to be covered in this PD session and how it will be organised. Including guidance on grouping tutors according to the subject/s, age phase/s. • Reflection on previous PD Session (Introduction to the course manual/s) • Introduction and overview of the main purpose of the lesson in the course manual/s	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity according to the subjects and age phases (e.g. numbers and their application in figures) 1.2 Expose tutors to the overview of the subject age phases to be covered in this PD session and how it will be organised. *viii.* ***Early and upper grade and JHS (Core)*** *lessons focus on topics student teachers had challenges in teaching and assessing at the phases in the semester within the basic school curriculum**.*** *ix.* ***JHS (Maths Sp)*** *lesson presents a revision on some identified dark spots that needs to be cleared in*	**Introduction** 1.1 Ice breaker activity: Begin with an investigational activity according to the subjects and age phases e.g. numbers and their application in figures) 1.2 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.	

• Identification of important or distinctive aspects of the lesson/s • Reading and discussion of the introductory sections up to learning outcomes	*integration: teaching applying.* 1.3 Ask a critical friend to give feedback on observation during the semester. N/B: Draw tutors' attention to all NTS references. 1.4 Ask tutors to tell how useful the PD sessions for the semester were and how they influenced their teaching in the semester. 1.5 Ask tutors to suggest the purpose of the lesson and state their expectations of the PD Session. 1.6 Ask tutors to read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate 1.7 Guide tutors to establish the linkage between CLOs and the LOs of the lessons to be revised 1.8 Ask tutors in pairs to discuss the important or distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters. ***Distinctive aspects*** *include the interactive nature of the activities with emphasis on connecting concepts on lessons to be revised (creating addition*	1.3 As a critical friend, share with members feedback on observation during the teaching in the semester. N/B: Pay attention to all NTS references. 1.4 Explain how useful the PD sessions of the semester were and how they influenced their teaching in the semester. 1.5 Suggest the purpose of the lesson and state your expectations of the PD Session. 1.6 Read the overview of the various courses (of the various phases named above) and discuss the course learning outcomes (CLOs) in groups as appropriate 1.7 Participate in the identification of the CLOs and link them to the LOs of the lessons to be revised 1.8 In pairs, discuss the distinctive aspects of the lesson including vocabulary and fundamental concepts related to the components of the front matters.	

	facts, Effective assessment skills, key features of the basic school curriculum, applying a topic to real life with *other lessons and the use of relevant resources*. *a. Early Grade– eg. the use of TLMs to develop understanding of identified lessons to be revised.* *b. Upper Grade – eg. Activation of group project work, ICT and TLM to help student teachers develop understanding of identified lessons to be revised* *c. JHS (core) – eg. Activation of group project work, ICT and TLM to help student teachers develop understanding of identified lessons to be revised* *d. JHS (Math sp) – eg. More examples of application of integration to finding areas and volumes in real life situations* 1.9 Ask tutors to read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lessons to be revised. N/B *Be ready for likely questions from tutors for clarification.* ***Anticipated questions:*** *x. What if a students is not following ALL topics thought?*	1.9 Read and discuss the introductory sections of the lesson (up to Learning Outcomes) and suggest the relevant students' previous knowledge that can support the teaching and learning of the lessons to be revised.	

The guidance notes for SL/HoD need to • *Provide short overview of the lesson* • *Identify important or distinctive features of the lesson* • *Identify assessment, aligned to NTEAP* • *Anticipate questions which might arise from the introduction to the lesson and provide responses for SL/HoD.* • *Issues that prompted questions or discussion during curriculum and course writing may well also be issues for SL/HoD*			
2. Concept Development (New learning likely to arise in this lesson): • Identification and discussion of concepts • Identification of possible challenging areas in teaching of the concept. • Identification of needed resources for the teaching and learning of the concept.	**Concept Development** 2.1 Lead tutors to identify familiar and unfamiliar concepts in the lessons and discuss connections among concepts in the lessons to be revised. 2.2 Ask tutors to outline possible challenging areas in the lessons to be revised taking into consideration GESI 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 and creating a safe,*	**Concept Development** 2.1 Identify familiar and unfamiliar concepts in the lessons and discuss connections among concepts in the lesson to be revised. 2.2 Outline possible challenging areas in the lessons to be revised taking into consideration **GESI**.	**25 mins**

	secure, happy, and stimulating learning environment (NTS 3c 3f, pg. 14). 2.3 Lead tutors to discuss misconceptions and barriers in teaching and learning of the lessons identified for each of the phases. 2.4 Support tutors to identify GESI responsive resources such as supporting staff for sign language, projectors, flip charts, sticky notes, tactile that can be used in the teaching and learning of the concepts mentioned above (e.g. curriculum materials, teachers and leaners resource packs, textbooks, course manual, etc.) NTS 3j *i. Need to identify any aspect of the lessons to be revised that might be challenging for tutors in terms of new learning which need to be considered prior to taking tutors through the lessons. This could have been noted during the semester* *ii. Need to identify needed resources well suited for each lesson to be revised.*	2.3 Participate in the discussion on misconceptions and barriers in teaching and learning of the lesson. 2.4 Identify as many GESI responsive resources as possible that can be used in the lessons to be revised NTS 3j	
Guidance notes for SL/HoD should • *Identify any aspect of the lesson that might be challenging for tutors in terms of new learning and which needs to be*			

considered prior to taking tutors through the lesson activities " walk through". • *The resources needed must be identified: literature – page referenced etc, on web, Utube, physical resources, power point; how they should be used. Consideration needs to be given to local availability* *This section can build on the PD needs identified from the course manuals*			
3. Teaching, learning and assessment activities for the lesson • Reading of teaching and learning activities and identification of areas that require clarification • Reading of assessment opportunities and ensuring they are aligned to the NTEAP and required course assessment: subject project (30%), subject portfolio (30%) and end of semester examination (40%)	**Teaching and learning activities** 3.1 Ask tutors to suggest teaching and learning activities for the lessons to be revised 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 Ref: Writing the weekly PD session-pp 3., NTS 1a, b, c, d, 2b, e, f, 3b, c 3.2 Ask tutors read the activities outlined in the course manual and identify areas that require clarification. *Strategies to clarify the otherwise dark spots may include investigation, internet search, etc.*	**Teaching and learning activities** 3.1 Suggest teaching and learning activities for the lesson to be revised taking into account GESI issues. 3.2 Read the activities outlined in the course manual and identify areas that require clarification.	**40 mins**

• Working through one or two activities,	3.3 Ask tutors to discuss the assessment strategies to be used during teaching of the lessons to be revised (NTS 3k). *Assessment must be aligned to the NTEAP and required course Assessment to include subject project (30%), subject portfolio (30%) and end of semester examination (40%)* 3.4 Lead tutors to discuss the various ways they can support student teachers to build their portfolio and subject projects. 3.5 Ask tutors to 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) in the lessons to be revised. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii) Note *i. Select activities, linked to CLO and indicators, from the lessons to be revised that are likely to be most different from tutors* *ii. The selected activities should be done with tutors in real or close to real time* *iii. Identify where, and which, core and transferable skills, including 21st skills and the use of information skills*	3.3 Discuss the assessment strategies to be used during teaching of the lessons to be revised (NTS 3k). 3.4 Engage tutors to discuss the various ways they can support student teachers to build their portfolio 3.5 Engage tutors to model a presentation of an activity using ICT tools and taking into consideration GESI issues in the lessons to be revised. NTS 1a, b, 2b, e, 3b, c, J; BSC pp. iii)	
Guidance notes for SL/HoD should • *Select activities, linked to CLO and*			

indicators, from the lesson that are likely to be most different from tutors' previous experience. These could involve applying new content, e.g. from section 2, or approaches to teaching, learning and assessment, incl. gender responsive and inclusive approaches • *Identify how any assessments relate to course assessment components* • *The selected activities should be done with tutors in real or close to real time* • *Anticipate any issues for clarification or questions which might arise as the tutors work through the activities and provide guidance on these* • *Identify where, and which, core and transferable skills, including 21st skills and the use of information technology, are being developed or applied*			

• *Makes links to the existing PD Themes with page reference where they can support teaching, for example: action research, questioning and to other external reference material* • *Identify where power point presentations or other resources need to be developed to support learning and provide guidance* • *Identify resources required for any TLMs and provide guidance on development of these*			
4. Evaluation and review of session: • identification of any outstanding issues relating to this lesson for clarification • Advance preparation • In the case of unresolved issues	**Reflective Activity** 4.1 Lead tutors in self-evaluation as well as encourage tutors to provide feedback of the PD session taking into consideration inclusivity (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* – *put on SL/SWL WhatsApp platform for discussion* – *tutors to research for the next PD session for discussion*	**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 (NTS 1a, 3i). 4.2 Reflect on the activities in the session and outline unresolved issues relating to the lesson	**5 mins**

	Advance Preparation 4.3 Ask tutors to prepare sample mock examination questions for moderation N/B *XXIV. Remind tutors to identify a critical friend from the same or related discipline to observe during teaching and provide feedback (NTS 1a).* *XXV. Read the course manual, the PD session guide ahead of time to identify any outstanding issues relating to this lesson for clarification.* *XXVI. Collect all 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*	**Advance Preparation** 4.3 Ask tutors to prepare sample mock examination questions for moderation N/B *Get a critical friend from the same or related discipline to observe your lesson during teaching and provide feedback (NTS 1a).*	
Course assessment in accordance with the NTEAP: SWL need to review assessment in the course manual to ensure it complies with NTEAP implementation and the 60% continuous assessment and 40 % End of semester examination. This means ensuring subject project, subject portfolio preparation and development are explicitly addressed in the PD sessions.			

The PD session check list: supporting B.Ed. implementation.

In some cases, to support implementation the PD sessions may need to add more detail to what is in the course manuals

What to Include in PD sessions: Check list	Checked and In Place.
Course introductions and conclusions • The first PD session of each semester introduces the course manual/s and course expectations to student teachers. • The final PD session provides the opportunity to review student teachers learning from the course	
Prior knowledge: Points for tutors on assessing or activating student teachers' prior knowledge.	
Basic School Curriculum: when topics for student teachers are from the Basic School Curriculum the PD session makes explicit links.	
CLO: relevant to the session to be introduced	
Lesson Learning outcomes and indicators. PD **s**essions provide opportunities for tutors to model interactive approaches to teaching and learning they will use to support student teachers	
Integration of subject specific content and subject specific pedagogy. This is modelled in PD sessions through activities for tutors. Any potentially new or challenging concepts are explored with tutors	
Subject Specific Training. Where subjects have been grouped together for the PD sessions, tutors are guided to activities in the subject course manuals to ensure the PD is not generic. Where appropriate there is direct page or point references to activities in each of the relevant subject course manuals.	
Integrating GESI: each PD session explicitly highlights at least two (2) teaching and learning activities from the course manual/s which should be used to promote student teachers' understanding of GESI responsiveness and support the inclusion of all pupils.	
Assessment. Integrating and embedding NTEAP practices PD sessions include at least two continuous assessment opportunities which will support tutors in developing student teacher's understanding of and ability to apply assessment for or as learning.	
Phase Specific Training. Tutors are guided to specific activities in the relevant phase course manuals for EG, UP and JHS. Tutors are advised to group student teachers according to the phase they are training for specific activities.	
Building in STS. STS tasks are integrated into the PD sessions. Preparing for work in school and opportunities for tutors to draw on what student teachers are learning in school by, for example, targeting observations linked directly to the themes in the course manuals.	
Building in activities which support the development of 21c skills in particular the use of ICT. The development of these is integrated into the PD sessions including the	

use of ICT to support learning. Each PD session should include at least two (2) examples of students being required to use ICT to extend their learning.	
Resources /TLM. Where specific resources are required, it is clear where tutors can access them e.g., videos, online resources, or readings.	

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