TANZANIA MODULE

REPORT COMPENDIUM

The Open University of Tanzania

Table of Contents

Subject : Biology

Cell Structure & Organization

Authored by:
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1. Introduction

T his module targets fresh teacher graduates (1-9 years teaching experience) as the main participants, preparing them to teach this particular area for form one students. The module takes into consideration the requirements of ordinary level biology syllabus, suggestions from the consulted biology teachers as well as the time-frame for its implementation. The module developed from the topic Cell Structure and Organization is organized into three units as follows: the cell, types and characteristics of cells, eukaryotic cells in detail and cell differentiation and specialization.

A. Timeline of implementation in the country:

July 4, 2022 and September 21, 2022

B. Learning objectives

By the end of this module NQTs should be able to guide their students to:

i. list and draw the basic components (organelles) of prokaryotic and eukaryotic cells;
ii. describe the basic functions of the cellular components;
iii. compare the structure of animal and plant cells;
iv. explain the hierarchical organization of multicellular organisms from cells to tissues, organs, systems and organisms.

C. Number of units

The module consists of four units as mentioned in the introduction section above.

D. Concepts covered

Four major concepts are covered in this module namely: the cell, types and characteristics of cells, eukaryotic cells in detail and cell differentiation and specialization.

E. Resources - activities, readings

The main proposed teaching-learning activities included videos, quiz, group discussions, field visits and experiments, practice questions, self-assessment questions, video clips/you tube, and internet, pictures and assignments also they were issued with different links to get some materials/contents related to the module contents. Moreover, participants were issued with some links through which they could access OERs and other relevant materials to elaborate certain concepts. Some of these resources and pictures used are shared in the CoP groups as well as attached in their respective moodle accounts together with lesson plans and module reflection.

F. Nature and purpose of assessments

Quiz – aimed at assessing NQTs learning and memorization of the concepts; self-assessment questions – evaluate themselves their understanding of the concepts; group discussion – provided participants an opportunity to exchange their understanding of the concepts, clarify some concepts; experiments and practice – provide opportunity to practice and apply the theoretical knowledge the participants have acquired through various online resources including OERs. Teachers were also required to do several assessment activities, including pre- and post test assessments, submit three lesson plans and one module reflection.

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Preservice	Inservice	Total
1 - 20%	1	0	0	1
21 - 40%	1	0	0	1
41 - 60%	0	0	0	0
61 - 80%	1	0	0	1
81 - 100%	2	0	15	17
Total	5	0	15	20

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Preservice	Inservice	Total
Pre test	4	0	14	18
Session plans	4	0	14	18
Reflection	4	0	14	18
Post tests	4	0	14	18

We started the project with 5 NQTs and 15 In-service making a total of 20 teachers for the project implementation. However, in the course of project implementation 1 NQT and 1 in-service teacher dropped out so after pre-test assessment for module 1 which was attended by all 20 teachers the remaining sections and modules were attended by 18 teachers only (Table 1 & 2).

3. Time spent on the course platform

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Preservice	Inservice	Total
Less than 5	2	0	10	12
5 to 10	1	0	4	5
10 to 20	2	0	1	3
21 to 30	0	0	0	0
More than 30	0	0	0	0
Total	5	0	15	20

4. Change from pre- and post- test

Average total score in pre-test - 4.39 out of 10
Average total score in post-test - 5.11 out of 10

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice		1		
	26-50% Emerging		5	2	
	51-75% Proficient		2	5	
	76-100% Accomplished				

Only 15 teachers have attempted both pre- and post tests hence, it's their scores that has been used to compute a change from pre- and post tests. According to Table 4, scores for 1 teacher improved from 26-50% (N) to 50-75% (P) and the scores for 2 teachers increased from the range of 0-25% (N) to 25-50% (P). However, 2 teachers have recorded lower scores (E) in post test compared to higher score (P) earned in pre-test. On the other hand, ten teachers retained their grades for both pre- and post tests at Emerging (25-50%) and Proficient (75-100%) whereas 5 teachers from each category retained their grades.

5. Practice

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	0	13	5	18
2. Nature of Science/ Mathematics	0	1	14	3	18
B. Pedagogical Content Knowledge					
3. Instructional Strategies	0	0	15	3	18
4. Students' misconceptions & Learning Difficulties	0	6	12	0	18
5. Representation of the Content	0	1	17	0	18
6. Context for Learning	0	4	13	1	18
7. Curriculum knowledge	0	3	15	0	18
C. General Pedagogical Knowledge					
8. Equity and Inclusion	1	8	9	0	18
9. Classroom Management	0	0	17	1	18
10. Assessment	0	0	16	2	18
Total	1	23	141	15	180

A. Subject Matter Knowledge

Most participants seem to have good subject matter knowledge as justified by their lesson plans, teaching experience as well as their academic profiles whereas most of the teachers involved were the holders of bachelor degrees. About 95% of all teachers fall under Proficient and Accomplished an indication that they have knowledge of interconnections between concepts, have ability to justify knowledge within the discipline as well as ability to communicate nature and structure of biology/science. On the other hand, teachers valued the project as it exposed them with the new teaching approaches including the use of available environment and digital tools that offered them an access to various teaching resources like OERs.

B. Pedagogical Content Knowledge

About 70% of the teachers have scored a P grade which signifies that their lesson plans were well planned and facilitated with various teaching-learning strategies as well as clear experience and knowledge on how to address misconceptions and any learning difficulties. The planned flow of lesson contents demonstrated the competence of participants to the lesson content. However, about 15% falls under emerging (26-50%) category whereby students' misconceptions and learning difficulties as well as context for learning were the main factors. This could be a result of negative perceptions against science whereas the form one students are the major victims of those rumors. Moreover, the language barrier among students in secondary schools following the changes in medium of instructions from Swahili used in primary schools to English in secondary schools. The barrier complicates communication between students and their teachers.

C. General Pedagogical Knowledge

Most plans revealed weakness in considering the learners with different requirements as well as the slow learners. About 15% of the plans and reflections didn't incorporate or use UDL principles to design and implement UDL principles to meet diverse needs of the learners. Their plans employed few learning skills and techniques that would not accommodate all learners at a time. This weakness could be attributed to lack of some instruments like computers as well as the large number of students in the classrooms that need more resources to meet the actual requirements and thus, ensure participation of each learner in the classroom. On the other hand, more than 70% of the teachers believed in the provision of equal opportunities to all learners to participate in the classroom interactions.

6. Social learning in CoPs

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	53
Preservice Teachers	0
Inservice Teachers	61
Teacher Educators	74
Research fellow	38
Total	**226**

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	1
UDL	5
Technical	6
Communication/ Administrative	214
Total	**226**

Table 7.2 : Frequency of posts by type

Type of post	Number of posts
Text only	201
Images	11
External Links to other resources	2
Others (pdf)	12
Total	**226**

C. Qualitative dialogues/ discussion threads

1. PCK:

Here the teacher sought clarifications on some concepts/terms used in the lesson plan template (Figure 6.1). The teacher shared his query in the Biology CoP to provide opportunity for TEs and fellow teachers to share their ideas then come up with common understanding on this PCK oriented query.
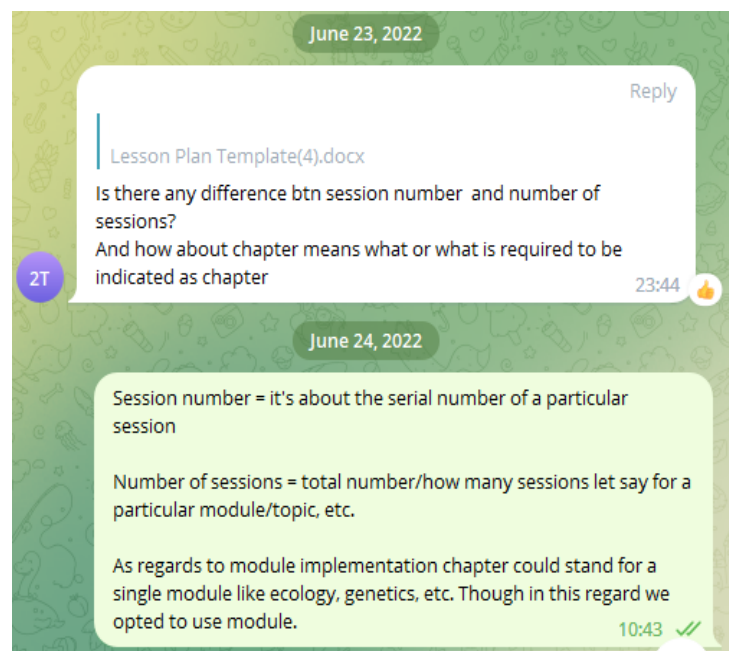

Figure 6.1: TE raised concerns and its response

2. Extension of the learning:

The teacher shared the classroom practice with fellow teachers and TE in the CoP. The commonly used instructional strategies involved the use of digital resources for the purpose of simplifying teaching as well as illustrating some concepts easily. Other instructional strategy seen in the pictures is group discussions as well as the use of locally available resources (Fig. 6.2).
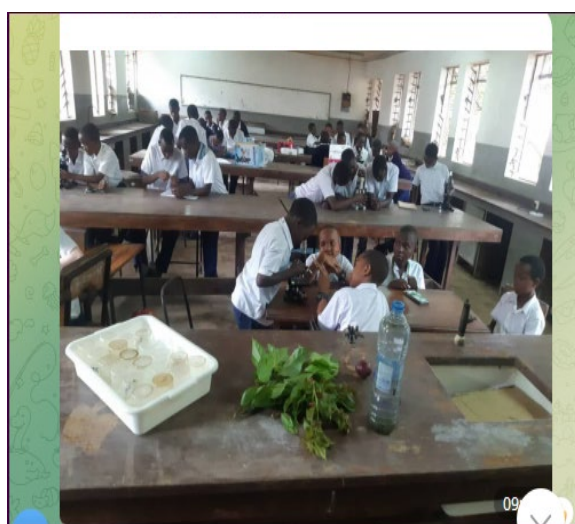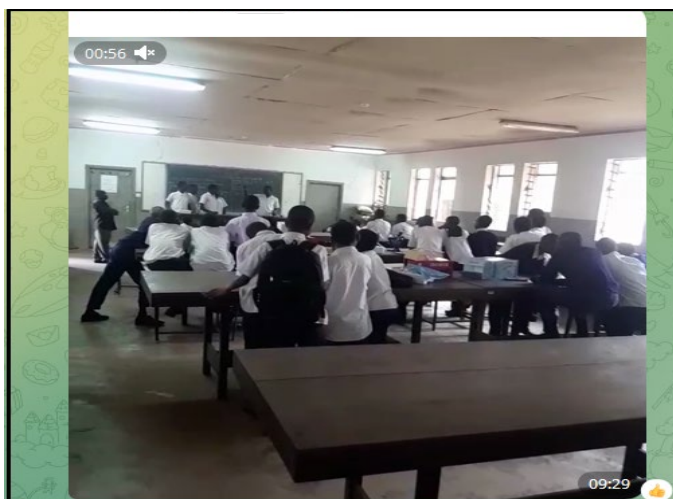
Fig. 6.2 Module implementation sessions

3. Inclusion:

The teacher was sharing the pictures on how students with impairments are taken care of in the classroom (Fig. 6.3).

Fig. 6.3: Students with impairments in a normal classroom

# 7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers

The use of online approach/moodle as well as getting exposure and access to various applications was very useful experience since participants get exposed to various approaches and sources for teaching-learning materials. Creation of CoP groups was also a new approach to most of our participants hence, adapted the same approach with their fellow teachers in their working places.

B. Challenges

The major challenges included:

i. Decision of two participants to drop out from the project besides various efforts aimed at engaging them back to the project. In most instances we're interacting with the teachers through a combination of approaches including making a direct call via their respective mobile phone numbers as well as normal SMS or through biology social platforms such as WhatsApp and telegram groups.

ii. Untimely response and submission of various tasks such as lesson plans and reflections and these could be attributed to the tight schedule at their working places (Fig. 7.1a & b). Likewise, some teachers visited their e-learning platform/moodle accounts as well as their domain CoP group in very rare occasions such as when they are reminded to submit lesson plan and the like. Such behavior to some extent caused the teachers not following the module contents effectively as well as being un-informed of any project progress thus could be one of the reasons for late submissions of lesson plans and reflections.

iii.
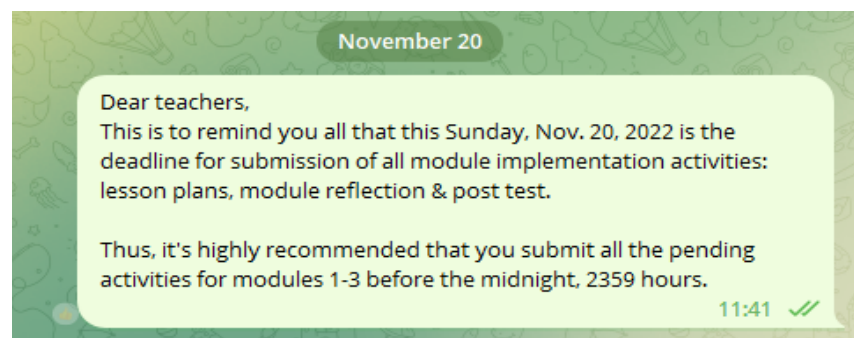
Fig. 7.1a Reminder to submit activities
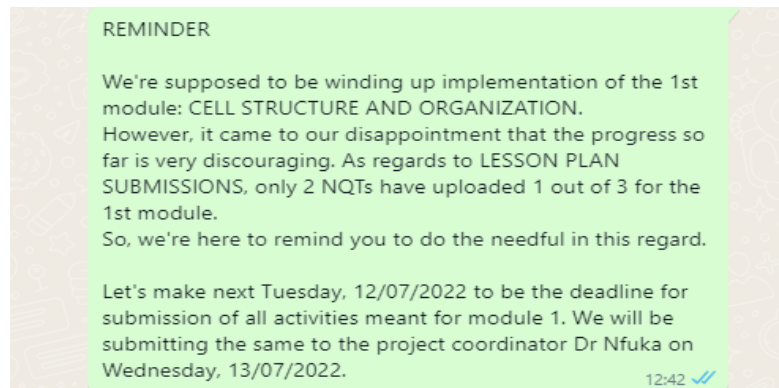
Fig. 7.1b Reminder to submit activities

Some participants were not teaching the classes to which the module content was aimed at. For instance, cell structure and organization is a form 1 topic but the teacher in the project could be assigned to teach form 4 so, the responsible teacher faced some difficulties in implementing this module. Likewise, the teacher could be assigned the class to which a respective module contents are meant but the content has already been covered in the preceding periods.

C. Surprises

In some instances, some teachers decided to withdraw from the project and their major reason was the tight schedule at their working places. We had repetitive calls for each respective course domain and at last it was decided by our leader that we have to visit them at their working stations talk to them also, to have a chance to meet with their leaders. We did so, and it was very fruitful since most of the participants agreed to continue with the project. For the case of biology, we couldn't reinstate two teachers only.

D. Any changes required in the module design

The module was well designed whereas; requirements of the local syllabus were taken into consideration. Moreover, the module is flexible with various suggested activities and learning resources that could be found in different areas of the country.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre test and post test data
4. All teachers' lesson plans and reflections
5. Teachers' responses for the pre and post test surveys
6. Telegram CoP group data download for the during of the module
7. Grading sheet

Subject : Biology

Introduction to Genetics & Heredity

Authored by:
Dr. Hassan Mateka and Mrs. Neema Magambo

1. Introduction

T
his module is designed to target fresh teacher graduates (1-9 years teaching experience) as the main participants, preparing them to teach this particular area for form 4 students. The module was prepared with respect to the requirements of ordinary level biology syllabus, suggestions from the consulted biology teachers as well as the time-frame for its implementation. The module developed from the topic Genetics and Heredity it consists of seven units as follow: concepts of genetics, genetic materials, principles of inheritance, sex determination and inheritance, variation among organisms, genetic disorder and application of genetics.

A. Timeline of implementation in the country:

September 22, 2022 – October 6, 2022

B. Learning objectives

By the end of this module NQTs should be able to guide their students to:

i. Explain the concept and terms used in genetics.
ii. Describe the structure and chemical composition of DNA
iii. Describe and state the Mendelian laws of inheritance
iv. Describe Non-Mendelian inheritance and its examples
v. Explain mechanisms of sex determination and inheritance
vi. Describe the concepts of sex-linked and sex-influenced characteristics
vii. Explain the concept and causes of variations among organisms
viii. Identify the types, explain the causes and effects of genetic disorders
ix. Describe some applications of genetics in everyday life
x. Discuss the advantages and disadvantages of genetics applications for the human health and environment

C. Number of units

The module consists of seven units as mentioned in the introduction section above.

D. Concepts covered

Seven concepts are covered in this module namely: concepts of genetics, genetic materials, principles of inheritance, sex determination and inheritance, variation among organisms, genetic disorder and application of genetics

E. Resources - activities, readings

The main proposed teaching-learning activities included videos, quiz, group discussions, experiments, practice questions, self-assessment questions, and assignments and, issued with different links to get some materials/contents related to the module contents. Moreover, participants are issued with some links where they can access OERs and other relevant materials for the respective module contents for the purpose of elaboration of concepts.

F. Nature and purpose of assessments

Quiz – aimed at assessing NQTs learning and memorization of the concepts; self-assessment questions – evaluate themselves their understanding of the concepts; group discussion – provided participants an opportunity to exchange their understanding of the concepts, clarify some concepts; experiments and practice – provide opportunity to practice and apply the theoretical knowledge the participants have acquired through various online resources including OERs.

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Preservice	Inservice	Total
1 - 20%	1	0	1	2
21 - 40%	0	0	0	0
41 - 60%	0	0	0	0
61 - 80%	0	0	0	0
81 - 100%	4	0	14	18
Total	5	0	15	20

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Preservice	Inservice	Total
Pre test	5	0	15	20
Session plans	4	0	14	18
Reflection	4	0	14	18
Post tests	4	0	14	18

We started the project with 5 NQTs and 15 In-service making a total of 20 teachers for the project implementation. However, in the course of project implementation 1 NQT and 1 in-service teacher dropped out so after pre-test assessment which was attended by all teachers the remaining sections were attended by 18 teachers only (Table 1 & 2).

3. Time spent on the course platform

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Preservice	Inservice	Total
Less than 5	4	0	15	19
5 to 10	1	0	0	1
10 to 20	0	0	0	0
21 to 30	0	0	0	0
More than 30	0	0	0	0
Total	5	0	15	20

Large number of teachers spent less time on course platform since most of the time they were complaining of tight schedule in their working stations hence, the project activities were regarded as an extra duty.

4. Change from pre- and post- test

Average total score in pre-test - 5.76 out of 10
Average total score in post-test - 6.45 out of 10

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice				
	26-50% Emerging		*1	****4	*1
	51-75% Proficient		*1	*****5	*1
	76-100% Accomplished		*1	*1	

Only 15 participants have appeared for both pre- and post tests hence, it's their scores that has been used to compute a change from pre- and post tests. According to Table 4, scores for 4 participants improved from 26-50% to 50-75% and the scores for 1 participant increased from the range of 26-50% to 75-100%. Likewise, 5 teachers improved their scores from 26-50% to 50-70% and 1 to 75-100%. On the other hand, one participant has improved scores from 25-50% to 50-75%.

5. Practice

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	0	14	4	**18**
2. Nature of Science/ Mathematics	0	1	14	3	**18**
B. Pedagogical Content Knowledge					
3. Instructional Strategies	0	0	13	5	**18**
4. Students' misconceptions & Learning Difficulties	0	0	14	4	**18**
5. Representation of the Content	0	0	16	2	**18**
6. Context for Learning	0	1	16	1	**18**
7. Curriculum knowledge	0	0	14	4	**18**
C. General Pedagogical Knowledge					
8. Equity and Inclusion	0	7	11	0	**18**
9. Classroom Management	0	0	16	2	**18**
10. Assessment	0	0	14	4	**18**
Total	**0**	**9**	**142**	**29**	**180**

A. Subject Matter Knowledge

Most participants seem to have good subject matter knowledge as justified by their lesson plans, teaching experience as well as their academic profiles whereas most of the teachers involved were the holders of bachelor degrees. Likewise, the participants valued the project as it exposed them with the new teaching approaches including the use of available environment and digital tools that offered them an access to various teaching resources like OERs.

B. Pedagogical Content Knowledge

Their lesson plans revealed that participants are well equipped with various teaching-learning strategies with some clear experience and knowledge on how to address misconceptions and any learning difficulties. The planned flow of lesson contents demonstrated the competence of participants to the lesson contents.

C. General Pedagogical Knowledge

Most plans revealed weakness in considering the learners with different requirements as well as the slow learners though the teachers seem to be aware of multiple modes of classroom interactions. This is justified with about 40% of the participants falling to Emerging and the remaining proportions (60%) fall under proficient. This 40% (weakness) could be attributed to the application few skills and techniques probably due to the lack of some instruments like computers as well as the large number of students in the classrooms.

6. Social learning in CoPs

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	21
Preservice Teachers	0
Inservice Teachers	18
Teacher Educators	46
Research fellow	0
Total	**85**

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	1
UDL	9
Technical	6
Communication/ Administrative	78
Total	**85**

Table 7.2: Frequency of posts by type

Type of post	Number of posts
Text only	70
Images	7
External Links to other resources	0
Others (pdf)	8
Total	**85**

C. Qualitative dialogues/ discussion threads

1. PCK:
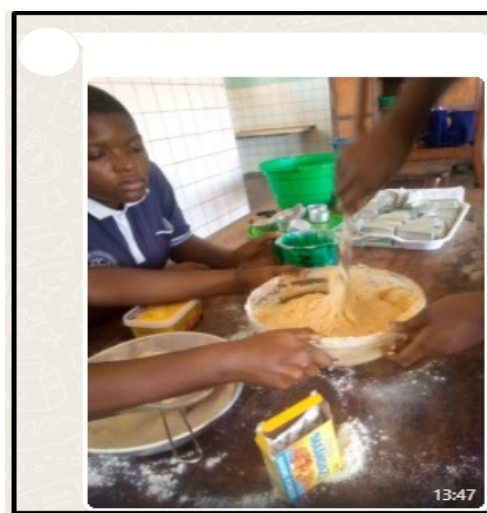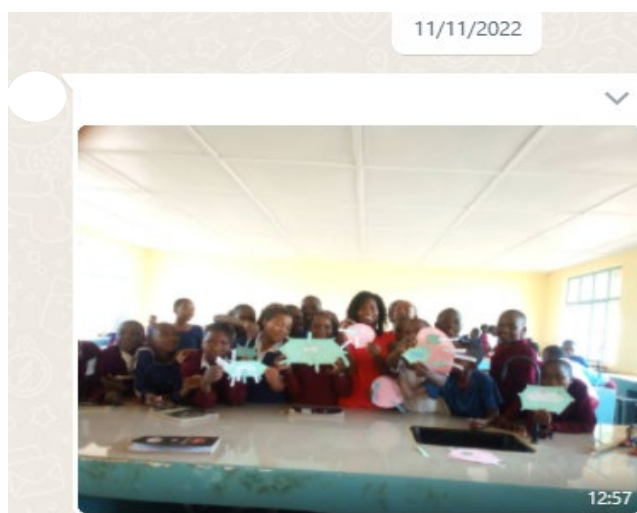
The message was sent by TE to clarify some issues raised by the teachers with regard to instructional strategies and assessment (Fig. 6.1).

In Blooms Taxonomy of educational objectives classificatic ✓ based on specificity and complexion, we have three hierarchy. The first one is cognitive domain which is purely based on ability to recall concepts exactly they way they are in literature such as textbooks etc. Some examples of the action verbs used under this domain are; list, state, mention e.t.c The second one is affective domain which is purely based on the learner's views, perceptions understanding of the concepts. Some examples of the action verbs used under this domain are; explain, discuss and examine etc. The third one is psychomotor domain which is purely based on the movement of the body to teach or learn concepts. Some examples of the action verbs used in psychomotor domain are; draw, demonstrate and construct etc. This will help the teachers in stating their behavioral objectives and evaluating their lessons properly.   06:42 ✓✓

Figure 6.1: Clarification of stages of students' assessment

2. Sharing classroom practice:

The teacher used the available resources in the school surroundings to illustrate some genetics concepts to the students (Fig. 6.2).

Sec students where used the varieties of flowers and leaves to show the role of Genetic materials in living things   17:36

Fig. 6.2 Module implementation sessions

# 7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers

The use of online approach/moodle as well as getting exposure and access to various applications was very useful since participants get exposed to various approaches and sources for teaching-learning materials. Creation of CoP groups was also a new approach to our participants hence, adapted the same approach with their fellow teachers in their districts.
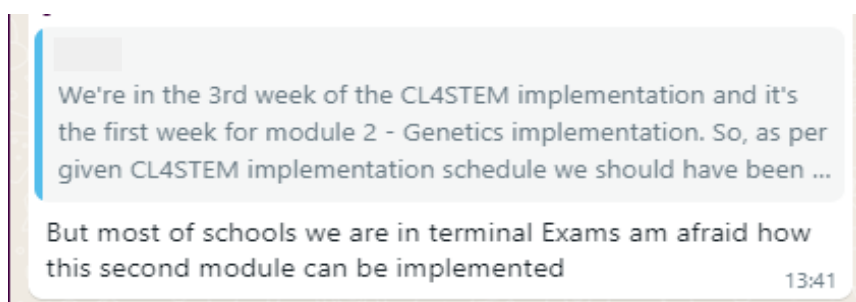
B. Challenges

The major challenges included:

i.   Decision of two participants to drop out from the project besides various efforts aimed at engaging them back to the project. In most instances we're interacting with the teachers through a combination of approaches including making a direct call via their respective mobile phone numbers as well as normal SMS or through biology social platforms such as WhatsApp and telegram groups.

ii. Untimely response and submission of various tasks such as lesson plans and reflections and these could be attributed to the tight schedule at their working places (Fig. 7.1a, b & c).
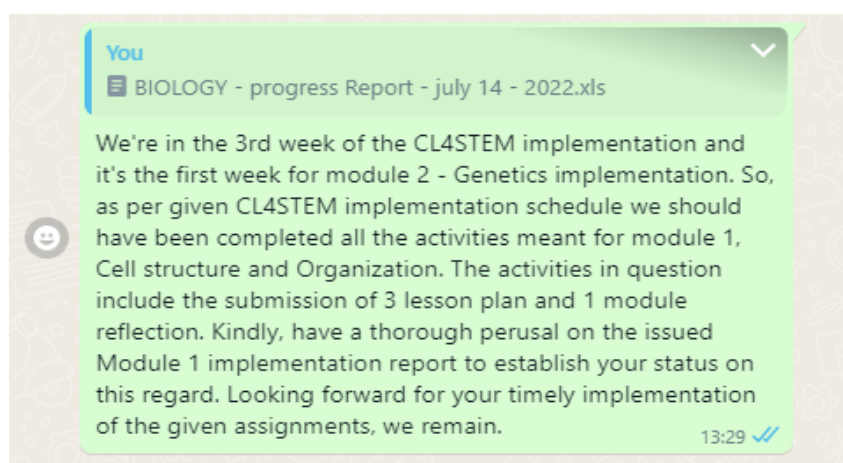
*Fig. 7.1a Reminder to submit activities on time*

*Fig. 7.1b Response from the teacher*
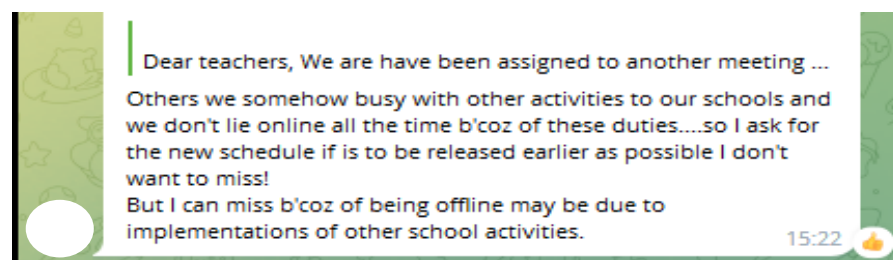
Fig. 7.1c Challenges in module implementations

Some participants were not teaching the classes to which the module content was aimed at. For instance, cell structure and organization is a form 1 topic but the teacher in the project could be assigned to teach form 4 so, the responsible teacher faced some difficulties in implementing this module. Likewise, the teacher could be assigned the class to which the respective module contents are meant but the content has already been covered in the previous sessions (Fig. 7.2a&b).
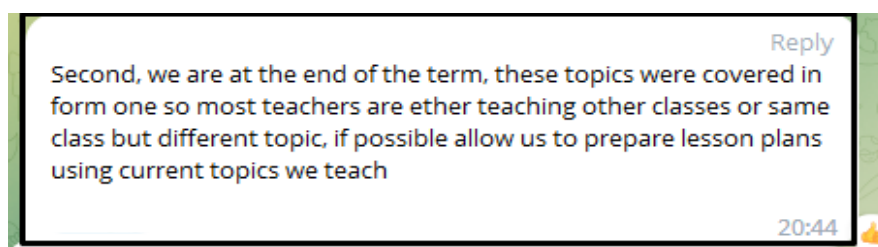
Fig. 7.2a Challenges in module implementation
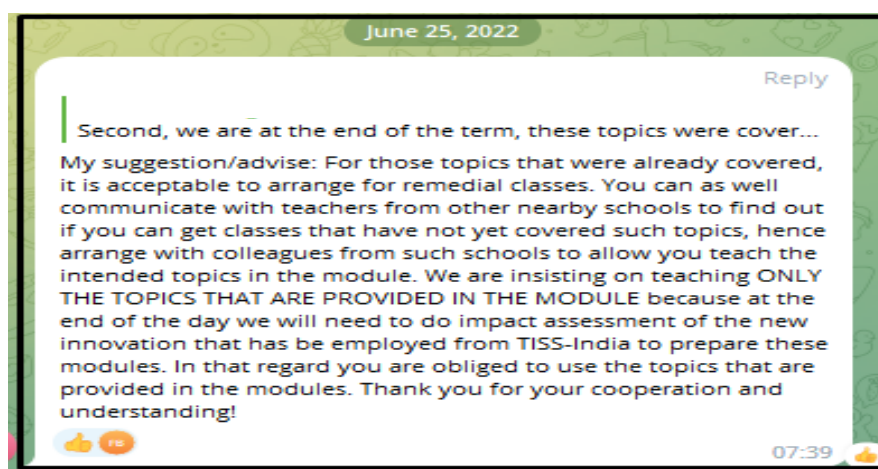
Fig. 7.2b Challenges in module implementation

C. Surprises

In some instances, some teachers decided to withdraw from the project and their major reason was the tight schedule at their working places. We had repetitive calls for each respective course domain and at last it was decided by our project leader that we have to visit them at their respective working stations over there, we also had an opportunity to meet with their leaders. We did so, and it was very fruitful since most of the participants agreed to continue with the project. For the case of biology, we couldn't reinstate two teachers only.

D. Any changes required in the module design

The module was well designed whereas; requirements of the local biology syllabus were taken into consideration. Moreover, the module is flexible with various suggested activities and learning resources that could be found in different areas of the country.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre test and post test data
4. All teachers' lesson plans and reflections
5. Teachers' responses for the pre and post test surveys
6. Telegram CoP group data download for the during of the module

Subject : Biology

Balance of Nature

Authored by:
Dr. Hassan Mateka and Mrs. Neema Magambo

1. Introduction

This module targets fresh teacher graduates (1-9 years teaching experience) as the main participants, preparing them to teach this particular area for form 2 students. The module takes into considerations the requirements of ordinary level biology syllabus, suggestions from the consulted biology teachers as well as the time-frame for its implementation. The module developed from the topic Balance of Nature is divided into three units as follow: the natural environment, interactions of organisms in the environment and the food chain and food web.

A. Timeline of implementation in the country:

October 7, 2022 – November 21, 2022

B. Learning objectives

By the end of this module NQTs should be able to guide their students to:

i. explain the concept of natural environment
ii. describe biotic and abiotic components of environment
iii. identify various organisms available in a natural environment
iv. describe interactions among components of environment
v. explain the concepts of food chain and food web

C. Number of units

The module consists of three units as mentioned in the introduction section above.

D. Concepts covered

Three major concepts are covered in this module namely: the natural environment, interactions of organisms in the environment and the food chain and food web.

E. Resources - activities, readings

The main proposed teaching-learning activities included videos, quiz, group discussions, field visits and experiments, practice questions, self-assessment questions, and assignments also they were issued with different links to get some materials/contents related to the module contents. Moreover, participants were issued with some links through which they could access OERs and other relevant materials to elaborate certain concepts.

F. Nature and purpose of assessments

Quiz – aimed at assessing NQTs learning and memorization of the concepts; self-assessment questions – evaluate themselves their understanding of the concepts; group discussion – provided participants an opportunity to exchange their understanding of the concepts, clarify some concepts; experiments and practice – provide opportunity to practice and apply the theoretical knowledge the participants have acquired through various online resources including OERs.

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Preservice	Inservice	Total
1 - 20%	1	0	1	2
21 - 40%	0	0	0	0
41 - 60%	0	0	0	0
61 - 80%	0	0	0	0
81 - 100%	4	0	14	18
Total	5	0	15	20

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Preservice	Inservice	Total
Pre test	4	0	14	18
Session plans	4	0	14	18
Reflection	4	0	14	18
Post tests	4	0	14	18

We started the project with 5 NQTs and 15 In-service making a total of 20 teachers for the project implementation. However, in the course of project implementation 1 NQT and 1 in-service teacher dropped out so after pre-test assessment for module 1 which was attended by all 20 teachers the remaining sections and modules were attended by 18 teachers only (Table 1 & 2).

3. Time spent on the course platform

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Preservice	Inservice	Total
Less than 5	2	0	12	**14**
5 to 10	2	0	2	**4**
10 to 20	0	0	0	**0**
21 to 30	0	0	0	**0**
More than 30	0	0	0	**0**
Total	**4**	**0**	**14**	**18**

Large number of teachers spent less time on course platform since most of the time they were complaining of tight schedule in their working stations hence, the project activities were regarded as an extra duty.

4. Change from pre- and post- test

Average total score in pre-test - 4.74 out of 10
Average total score in post-test - 5.21 out of 10

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice			2	
	26-50% Emerging		5	1	
	51-75% Proficient		4	5	
	76-100% Accomplished				

Only 17 teachers have attempted both pre- and post tests hence, it's their scores that has been used to compute a change from pre- and post tests. According to Table 4, scores for 2 teachers improved from 26-50% (N) to 50-75% (P) and the scores for 1 participant increased from the range of 26-50% (E) to 75-100% (P). However, 4 teachers have recorded lower scores (E) in post test compared to higher score (P) earned in pre-test. On the other hand, five teachers retained their grades for both pre- and post tests.

5. Practice

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	0	12	6	18
2. Nature of Science/ Mathematics	0	1	13	4	18
B. Pedagogical Content Knowledge					
3. Instructional Strategies	0	0	16	2	18
4. Students' misconceptions & Learning Difficulties	0	6	12	0	18
5. Representation of the Content	0	0	17	1	18
6. Context for Learning	0	2	16	0	18
7. Curriculum knowledge	0	0	14	4	18
C. General Pedagogical Knowledge					
8. Equity and Inclusion	0	8	9	1	18
9. Classroom Management	0	0	17	1	18
10. Assessment	0	0	16	2	18
Total	0	17	142	21	180

A. Subject Matter Knowledge

Most participants seem to have good subject matter knowledge as justified by their lesson plans, teaching experience as well as their academic profiles whereas most of the teachers involved were the holders of bachelor degrees. About 95% of all teachers fall under Proficient and Accomplished an indication that they have knowledge of interconnections between concepts, have ability to justify knowledge within the discipline as well as ability to communicate nature and structure of biology/science. On the other hand, teachers valued the project as it exposed them with the new teaching approaches including the use of available environment and digital tools that offered them an access to various teaching resources like OERs.

B. Pedagogical Content Knowledge

About 70% of the teachers have scored a P grade which signifies that their lesson plans were well planned and facilitated with various teaching-learning strategies as well as clear experience and knowledge on how to address misconceptions and any learning difficulties. The planned flow of lesson contents demonstrated the competence of participants to the lesson content.

C. General Pedagogical Knowledge

Most plans revealed weakness in considering the learners with different requirements as well as the slow learners. About 95% of the teachers were in either E or P hence; believe in provision of equal opportunities to all learners to participate in the classroom interactions. Most plans employed few learning skills and techniques that would not accommodate all learners at a time. This weakness could be attributed to lack of some instruments like computers as well as the large number of students in the classrooms that need more resources to meet the actual requirements and thus, ensure participation of each learner in the classroom.

6. Social learning in CoPs

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	23
Preservice Teachers	0
Inservice Teachers	39
Teacher Educators	80
Research fellow	8
Total	**150**

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	5
UDL	0
Technical	2
Communication/ Administrative	143
Total	**150**

Table 7.2: Frequency of posts by type

Type of post	Number of posts
Text only	131
Images	7
External Links to other resources	0
Others (pdf)	12
Total	**150**

C. Qualitative dialogues/ discussion threads

1. PCK:

Here the teacher sought clarifications on some concepts/terms used in assessment of students. The teacher shared his query to the group to provide opportunity for TEs and fellow teachers to share their ideas then come up with common understanding on this PCK oriented query.

Fig. 6.1 Clarification of the hierarchies of students' assessment

June 23, 2022

Also the concept of formative assessment I'm not understanding it in the session plan in prior knowledge any ony who knows please help me!!!
16

Any one to clarify forme please   16:38

Formative assessment ni tathimini unayopaswa kufa...

there are three types of assessment 1. Diagnostic assessment done before teaching and learning take place purposely to explore the prior knowledge i.e what they know concern with intended lesson 2. Formative assessment done during teaching and learning takes place purposely to measure efficient of piece of instructional provided e.g home work, quiz, monthly test, terminal exams   3. summative assessment done at the end of unit this can be annual exams, certificate of secondary education i.e form 4 and 6 NECTA exams

what are difference between chapter and Topic i get some confusion regarded to you explanation??
22:44

Session number = it's about the serial number of a particular ses...

let use vivid example , we have ecology module what are session number and number of sessions
22:50

2. Sharing classroom practice:

The teacher shared in the CoP the use of different instructional strategies and resources such as digital tools and group discussions for implementing the learning objectives (Fig. 6.2).

We got an opportunity to implement the module 3. The lesson focused on the concept of the food chain and food web   18:25

3. Inclusion:

The teacher was sharing the pictures showing how students with disabilities are handled and smoothly follow the sessions (Fig. 6.3).

Fig. 6.3 Students with disabilities following the session in the classroom

7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers

The use of online approach/moodle as well as getting exposure and access to various applications was very useful experience since participants get exposed to various approaches and sources for teaching-learning materials. Creation of CoP groups was also a new approach to most of our participants hence, adapted the same approach with their fellow teachers in their working places.

B. Challenges

The major challenges included:

i. Decision of two participants to drop out from the project besides various efforts aimed at engaging them back to the project. In most instances we're interacting with the teachers through a combination of approaches including making a direct call via their respective mobile phone numbers as well as normal SMS or through biology social platforms such as WhatsApp and telegram groups.

ii. Untimely response and submission of various tasks such as lesson plans and reflections and these could be attributed to the tight schedule at their working places (Fig. 7.1). Likewise, some teachers visited their e-learning platform/moodle accounts as well as their domain CoP group in very rare occasions such as when they are reminded to submit lesson plan and the like. Such behavior to some extent caused the teachers not following the module contents effectively as well as being un-informed of any project progress thus could be one of the reasons for late submissions of lesson plans and reflections.

Fig. 7.1 A teacher reminding her fellows on module activities completion

Some participants were not teaching the classes to which the module content was aimed at. For instance, cell structure and organization is a form 1 topic but the teacher in the project could be assigned to teach form 4 so, the responsible teacher faced some difficulties in implementing this module. Likewise, the teacher could be assigned the class to which a respective module contents are meant but the content has already been covered in the preceding periods.

C. Surprises

In some instances, some teachers decided to withdraw from the project and their major reason was the tight schedule at their working places. We had repetitive calls for each respective course domain and at last it was decided by our leader that we have to visit them at their working stations talk to them also, to have a chance to meet with their leaders. We did so, and it was very fruitful since most of the participants agreed to continue with the project. For the case of biology, we couldn't reinstate two teachers only.

D. Any changes required in the module design

The module was well designed whereas; requirements of the local syllabus were taken into consideration. Moreover, the module is flexible with various suggested activities and learning resources that could be found in different areas of the country.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre test and post test data
4. All teachers' lesson plans and reflections
5. Teachers' responses for the pre and post test surveys
6. Telegram CoP group data download for the during of the module

Subject : Chemistry

Atomic Structure

Authored by:
Dr. Harrieth Kihampa & Dr. James Mutasingwa

1. Introduction

A. Timeline of implementation in the country:

4th July 2022 to 21st September 2022

B. Learning objectives

Atomic structure module has been designed with an intention to enable a chemistry teacher teach chemistry concepts in an interactive manner, through encouraging full participation of students (Student-centered) in the teaching and learning process.

C. Number of units

The module consists of two units.

D. Concepts covered

i.   Atom as a building block of matter
ii. Dalton's atomic theory
iii. Subatomic particles
iv. Atomic number, mass number and isotopes
v.   Electron arrangement
vi. Energy levels of common elements

E. Resources - activities, readings

i.   Activity 1.1 to Activity 1.5
ii. Activity 2.1 to Activity 2.12

F. Nature and purpose of assessments

i.   Pre test
ii. Three lesson plans
iii. Module reflection
iv. Post test

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Others	Total
1 - 20%	0	3	3
21 - 40%	0	0	0
41 - 60%	0	0	0
61 - 80%	0	0	0
81 - 100%	5	12	17
Total	5	15	20

Data in Table 1 depicts that the overall completion rate of 3 teachers ranged between 0% and 20%, whereas 17 teachers had the overall completion rate ranging from 81% to 100%.

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Others	Total
Pre test	5	15	20
Lesson plan 1	5	12	17
Lesson plan 2	5	12	17
Lesson plan 3	5	12	17
Module Reflection	5	12	17
Post tests	5	12	17

Data in Table 2 shows that all 20 teachers attempted pre-test, whereas only 17 teachers appeared in the post test and submitted the post test. Regarding submission of Lesson plan 1, Lesson plan 2, Lesson plan 3 and Module reflection, only 17 teachers submitted the mentioned reports.

3. Time spent on the course platform

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Others	Total
Less than 10	2	7	9
10 to 20	3	4	7
21 to 30	0	4	4
More than 30	0	0	0
Total	5	15	20

Data in Table 3 indicates that out of 20 teachers, 9 teachers spent less than 10 hours in Moodle platform. The table also shows that 7 teachers spent 10 to 20 hours in Moodle platform. Only 4 teachers spent 21 to 30 hours in Moodle platform. Nobody spent more than 30 hours in the Moodle platform.

4. Change from pre- and post- test

Average total score in pre-test: 6.16 out of 10
Average total score in post-test: 6.47 out of 10

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice				
	26-50% Emerging			4	
	51-75% Proficient			10	
	76-100% Accomplished			1	2

The information in Table 4 shows that four participants improved from Emerging to Proficient level, ten participants remained the same at the Proficient level, and two maintained the same performance at Accomplished level in both tests, whereas one participant dropped from the Accomplished level to Proficient level. Generally, out of the 17 participants, four improved, ten remained the same and one dropped.

5. Practice

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	1	9	6	16
2. Nature of Science/ Mathematics	0	1	9	6	16
B. Pedagogical Content Knowledge					
3. Instructional Strategies	0	1	8	7	16
4. Students' misconceptions & Learning Difficulties	2	3	9	2	16
5. Representation of the Content	0	2	9	5	16
6. Context for Learning	1	2	10	3	16
7. Curriculum knowledge	2	2	9	3	16
C. General Pedagogical Knowledge					
8. Equity and Inclusion	0	5	11	0	16
9. Classroom Management	0	3	11	2	16
10. Assessment	0	1	14	1	16
Total	5	21	99	35	160

A. Subject Matter Knowledge

The participants demonstrated good knowledge of the subject matter, where more than 90% of them performed at the Proficient and Accomplished levels. The lesson plans showed a good ability to interconnect the concepts covered in Atomic Structure with other concepts in Chemistry. They also demonstrated awareness of the nature of science by including observations in the learning experience.

B. Pedagogical Content Knowledge

Most participants performed well in PCK. The lesson plans showed that more than 80% of them used classroom activities to foster discussions and to develop scientific thinking. They appropriately used locally available resources to facilitate learning. However, the area of students' misconception had the lowest performance.

C. General Pedagogical Knowledge

Overall, participants performed well in this area, where more than 90% were at the Proficient and Accomplished levels. Most of them used group discussions for classroom interactions. However, of the three criteria under this aspect, equity and inclusion was the least demonstrated.

6. Social learning in CoPs

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	21
Teachers	17
Teacher Educators	45
Research fellow	39
Total	**122**

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	0
UDL	0
Technical	0
Communication/ Administrative	122
Total	**122**

Table 7.2: Frequency of posts by type

Type of post	Number of posts
Text only	113
Images	2
External Links to other resources	4
Others (pdf)	3
Total	**122**

C. Qualitative dialogues/ discussion threads

While launching CL4STEM program in May 2022, a good number of chemistry teachers claimed to be overwhelmed by many responsibilities and activities they handle in their schools on daily basis, hence were afraid of not being able to participate well in the implementation of CL4STEM program. As a response and encouragement to such teachers, one chemistry teacher posted pictures and videos in telegram platform showing the way she was implementing CL4STEM lessons in chemistry classes, despite the tight schedule she had in her school. Few examples are shown hereunder:

1. Pictures showing a teaching aid meant to clarify the concept of electron configuration in the topic of atomic structure for the Form 2:

2. Pictures showing students in groups drawing structures that depict the way electrons are arranged in an atom, after grasping the concept through teaching aid:

3. Pictures showing the way students were organised in groups in one of the Form 2 chemistry CL4STEM lessons:

4. Pictures taken during CL4STEM chemistry classes depicting the way disabled are integrated in the learning process (i.e. equity & inclusion):

7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers

20 teachers (that involved NQTs and non-NQTs) were earmarked for the implementation of this Module of Atomic structure, although only 17 teachers managed to participate in the implementation of the module. 17 teachers participated well in reading the module materials in the moodle platform, as well as attending almost all activities that were given in the moodle. The strategy that was mostly employed to encourage teachers' participation in the module implementation was to remind them by sending messages in telegram CoP as well as making phone calls through their personal phone numbers. The topic of Atomic structure is normally taught in Form 2 according to Tanzania syllabus. Among the 17 teachers who were participating in the implementation of this module, several teachers were teaching other classes in their schools, other than Form 2 classes. In view of this scenario, we suggested to them that they liaise with their fellow teachers who are teaching Form 2 classes, to allow them teach the topic of Atomic structure to Form 2 students. We are glad that this plan worked well.

B. Challenges

Implementation of Atomic structure module faced several challenges including collision of schools' timetables with CL4STEM timetable of implementing the modules, mismatch between schools calendar and the CL4STEM schedule of implementing modules, some of the teachers who were involved in our CL4STEM program being assigned special academic assignments by their heads of schools or Ministry of Education which require them to work outside their schools premises etc.

C. Surprises

In Tanzania it was planned well in advance that the year 2022 was the year of census, which was planned to take place around mid 2022. This in a way impacted the timeframe of implementing our modules as a good number of teachers who were participating in CL4STEM program were involved in census activities.

D. Any changes required in the module design

Instead of using telegram as the only CoP platform, we suggest that additional platform of whatsapp be included in the communication.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre test and post test data
4. All teachers' lesson plans and reflections
5. Teachers' responses for the pre and post test surveys
6. Telegram CoP group data download for the during of the module
7. Grading Sheet

Subject : Chemistry

Chemical Bonding

Authored by:
Dr. Harrieth Kihampa & Dr. James Mutasingwa

1. Introduction

A. Timeline of implementation in the country:

22nd September 2022 to 06th October 2022

B. Learning objectives

Chemical bonding module has been designed with an intention to enable a chemistry teacher teach chemistry concepts in an interactive manner, through encouraging full participation of students (Student-centered) in the teaching and learning process.

C. Number of units

The module consists of Two units.

D. Concepts covered

i.   Chemical formulae
ii.   Empirical formulae
iii. Molecular formulae
iv.   Valence and oxidation state
v.   Covalent bonding
vi.   Electrovalent bonding and radicals

E. Resources - activities, readings

i.   Activity 1.1 to Activity 1.5
ii.   Activity 2.1 to Activity 2.7

F. Nature and purpose of assessments

i.   Pre test
ii.   Three lesson plans
iii. Module reflection
iv.   Post test

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Others	Total
1 - 20%	0	3	3
21 - 40%	0	0	0
41 - 60%	0	0	0
61 - 80%	0	0	0
81 - 100%	5	12	17
Total	5	15	20

Data in Table 1 depicts that the overall completion rate of 3 teachers ranged between 0% and 20%, whereas 17 teachers had the overall completion rate ranging from 81% to 100%.

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Others	Total
Pre test	5	15	20
Lesson plan 1	5	12	17
Lesson plan 2	5	12	17
Lesson plan 3	5	12	17
Module Reflection	5	12	17
Post tests	5	12	17

Data in Table 2 shows that all 20 teachers attempted pre-test, whereas only 17 teachers appeared in the post test and submitted the post test. Regarding submission of Lesson plan 1, Lesson plan 2, Lesson plan 3 and Module reflection, only 17 teachers submitted the mentioned reports.

3. Time spent on the course platform

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Others	Total
Less than 10	2	7	9
10 to 20	3	4	7
21 to 30	0	4	4
More than 30	0	0	0
Total	5	15	20

Data in Table 3 indicates that out of 20 teachers, 9 teachers spent less than 10 hours in Moodle platform. The table also shows that 7 teachers spent 10 to 20 hours in Moodle platform. Only 4 teachers spent 21 to 30 hours in Moodle platform. Nobody spent more than 30 hours in the Moodle platform.

4. Change from pre- and post- test

Average total score in pre-test: 5.82 out of 10
Average total score in post-test: 5.73 out of 10

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice				
	26-50% Emerging			4	
	51-75% Proficient	1	2	5	2
	76-100% Accomplished		1	2	

The information in Table 4 show that four participants improved from Emerging level to Proficient level, whereas two improved from the Proficient level to the Accomplished level. A total of five participants remained at the Proficient level during both tests. One participant dropped from the Proficient level to the Novice level, whereas two dropped from the Proficient level to the Emerging level, another one dropped from the Accomplished level to the Emerging level, and another two dropped from the Accomplished level to the Proficient level. In general, out of the 17 participants, six improved, five remained the same and 6 dropped.

5. Practice

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	1	4	12	17
2. Nature of Science/ Mathematics	1	8	6	2	17
B. Pedagogical Content Knowledge					
3. Instructional Strategies	1	7	6	3	17
4. Students' misconceptions & Learning Difficulties	11	6	0	0	17
5. Representation of the Content	2	1	10	4	17
6. Context for Learning	0	1	7	9	17
7. Curriculum knowledge	0	1	2	14	17
C. General Pedagogical Knowledge					
8. Equity and Inclusion	4	13	0	0	17
9. Classroom Management	1	3	9	4	17
10. Assessment	0	2	11	4	17
Total	20	43	55	52	170

A. Subject Matter Knowledge

The participants demonstrated excellent knowledge of the subject matter in this Module because 70% of them were in the Accomplished level. One of the reasons for this good performance was the ability to link the key concepts in Chemical Bonding with concepts from other topics such as Atomic Structure. However, knowledge of the nature of science was not well demonstrated, where 52% of the participants at the Novice and Emerging levels were more inclined towards the learning of facts rather than the advanced nature of science.

B. Pedagogical Content Knowledge

The PCK element was satisfactory demonstrated in this Module. Curriculum knowledge was the best presented aspect with more than 80% of the participants i.e.,14 out of 17 in the Accomplished level. This was demonstrated by their ability to link the concepts in Chemical Bonding with other subjects. However, students' misconceptions were not well demonstrated, where about 65% of the participants were in the Novice level, and there were none in the Proficient and Accomplished levels. In most of the lesson plans, participants did not identify ways of testing and addressing misconceptions.

In this part, classroom management and assessment aspects were well demonstrated, where majority of the participants were in the Proficient and Accomplished levels. This was demonstrated by their ability to use multiple modes of classroom interactions, including group activities. The equity and inclusion aspect was not adequately demonstrated because majority of the participants could not clearly describe strategies to include all students in classroom interactions.

6. Social learning in CoPs

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	7
Teachers	16
Teacher Educators	36
Research fellow	0
Total	**59**

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	0
UDL	0
Technical	2
Communication/ Administrative	57
Total	**59**

Table 7.2: Frequency of posts by type

Type of post	Number of posts
Text only	51
Images	2
External Links to other resources	0
Others (pdf)	6
Total	**59**

Several classroom pictures were posted by teachers in CoP telegram platform while implementing lessons related to chemical bonding. Few examples of such pictures are shown here below:

7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers

20 teachers (that involved NQTs and non-NQTs) were earmarked for the implementation of this Module of Chemical bonding, although only 17 teachers managed to participate in the implementation of the module. 17 teachers participated well in reading the module materials in the moodle platform, as well as attending almost all activities that were given in the moodle. The strategy that was mostly employed to encourage teachers' participation in the module implementation was to remind them by sending messages in telegram CoP as well as making phone calls through their personal phone numbers. The topic of Chemical bonding is normally taught in Form 2 according to Tanzania syllabus. Among the 17 teachers who were participating in the implementation of this module, several teachers were teaching other classes in their schools, other than Form 2 classes. In view of this scenario, we suggested to them that they liaise with their fellow teachers who are teaching Form 2 classes, to allow them teach the topic of Chemical bonding to Form 2 students. We are glad that this plan worked well.

B. Challenges

Implementation of Chemical bonding module faced several challenges including collision of schools' timetables with CL4STEM timetable of implementing the modules, mismatch between schools calendar and the CL4STEM schedule of implementing modules, some of the teachers who were involved in our CL4STEM program being assigned special academic assignments by their heads of schools or Ministry of Education which require them to work outside their schools premises etc.

C. Surprises

In Tanzania it was planned well in advance that the year 2022 was the year of census, which was planned to take place around mid 2022. This in a way impacted the timeframe of implementing our modules as a good number of teachers who were participating in CL4STEM program were involved in census activities.

D. Any changes required in the module design

Instead of using telegram as the only CoP platform, we suggest that additional platform of whatsapp be included in the communication.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre test and post test data
4. All teachers' lesson plans and reflections
5. Teachers' responses for the pre and post test surveys
6. Telegram CoP group data download for the during of the module
7. Grading Sheet

Subject : Chemistry

Organic Chemistry

Authored by:
Dr. Harrieth Kihampa & Dr. James Mutasingwa

1. Introduction

A. Timeline of implementation in the country:

07th October 2022 to 21st November 2022

B. Learning objectives

Organic chemistry module has been designed with an intention to enable a chemistry teacher teach chemistry concepts in an interactive manner, through encouraging full participation of students (Student-centered) in the teaching and learning process.

C. Number of units

The module consists of Three units.

D. Concepts covered

i. Origin of organic compounds
ii. Importance of organic chemistry in life
iii. Homologous series
iv. Nomenclature and isomerism
v. Properties of hydrocarbons
vi. Preparation of hydrocarbons
vii. Purification of hydrocarbons

E. Resources - activities, readings

i. Activity 1.1 to Activity 1.8
ii. Activity 2.1 to Activity 2.8
iii. Activity 3.1 to Activity 3.5

F. Nature and purpose of assessments

i. Pre test
ii. Three lesson plans
iii. Module reflection
iv. Post test

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Others	Total
1 - 20%	0	3	3
21 - 40%	0	0	0
41 - 60%	0	0	0
61 - 80%	0	0	0
81 - 100%	5	12	17
Total	5	15	20

Data in Table 1 depicts that the overall completion rate of 3 teachers ranged between 0% and 20%, whereas 17 teachers had the overall completion rate ranging from 81% to 100%.

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Others	Total
Pre test	5	15	20
Lesson plan 1	5	12	17
Lesson plan 2	5	12	17
Lesson plan 3	5	12	17
Module Reflection	5	12	17
Post tests	5	12	17

Data in Table 2 shows that all 20 teachers attempted pre-test, whereas only 17 teachers appeared in the post test and submitted the post test. Regarding submission of Lesson plan 1, Lesson plan 2, Lesson plan 3 and Module reflection, only 17 teachers submitted the mentioned reports.

3. Time spent on the course platform

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Others	Total
Less than 10	2	7	9
10 to 20	3	4	7
21 to 30	0	4	4
More than 30	0	0	0
Total	5	15	20

Data in Table 3 indicates that out of 20 teachers, 9 teachers spent less than 10 hours in Moodle platform. The table also shows that 7 teachers spent 10 to 20 hours in Moodle platform. Only 4 teachers spent 21 to 30 hours in Moodle platform. Nobody spent more than 30 hours in the Moodle platform.

4. Change from pre- and post- test

Average total score in pre-test: 5.10 out of 10
Average total score in post-test: 5.88 out of 10

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice		1	2	
	26-50% Emerging		1	4	
	51-75% Proficient		2	5	1
	76-100% Accomplished			1	

The information in Table 4 shows that one participant improved from Novice to Emerging, two improved from Novice to Proficient, four improved from Emerging to Proficient and one improved from Proficient to Accomplished. It also shows that one participant remained at the Emerging level and five participants remained at the Proficient level in both tests. It further shows that two participants dropped from Proficient to Emerging whereas one dropped from Accomplished to Proficient level. In general, out of the 17 participants, eight improved, six remained the same whereas three dropped.

5. Practice

Table 4

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	1	6	10	17
2. Nature of Science/ Mathematics	4	6	4	3	17
B. Pedagogical Content Knowledge					
3. Instructional Strategies	1	3	11	2	17
4. Students' misconceptions & Learning Difficulties	7	10	0	0	17
5. Representation of the Content	0	1	9	7	17
6. Context for Learning	0	1	9	7	17
7. Curriculum knowledge	1	0	5	11	17
C. General Pedagogical Knowledge					
8. Equity and Inclusion	6	11	0	0	17
9. Classroom Management	1	3	11	2	17
10. Assessment	0	4	11	2	17
Total	20	40	66	44	170

A. Subject Matter Knowledge

The participants' subject matter knowledge in this Module was good because 94% of them were in the Proficient and Accomplished levels. They were able to connect the key concepts in Organic Chemistry such as the structures of hydrocarbons with concepts from other topics such as Atomic Structure. However, in the nature of science, most of the lesson plans demonstrated more inclination towards the learning of facts rather than its advanced nature.

B. Pedagogical Content Knowledge

The participants' performances in the PCK were generally satisfactory. The best outcome was in the instructional strategies where about 65% of them effectively used classroom activities to promote active learning and students' involvement. However, students' misconceptions and learning difficulties was not well addressed because 41% of the participants were at the Novice level and 59% were Emerging. Most of the lesson plans and reflections demonstrated minimal awareness of how to identify misconceptions and learning difficulties. For example, students were not given chances to ask questions during the lessons.

C. General Pedagogical Knowledge

There was generally a good participants' performance in the general pedagogical knowledge because majority fell under the Proficient level, especially in classroom management and assessment. However, the aspect of equity and inclusion was not well demonstrated. For example, most lesson plans did not indicate how small groups for the classroom activities were formulated.

6. Social learning in CoPs

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	3
Teachers	18
Teacher Educators	74
Research fellow	8
Total	**103**

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	8
UDL	0
Technical	0
Communication/ Administrative	95
Total	**103**

Table 7.2: Frequency of posts by type

Type of post	Number of posts
Text only	86
Images	9
External Links to other resources	0
Others (pdf)	8
Total	**103**

C. Qualitative dialogues/ discussion threads

In implementing the module of Organic chemistry, we have good selected examples of screenshots of pictures that were posted by chemistry teachers in the CoP telegram platform, particularly those which relate to classroom practice, inclusion, group work among students, and students' hands-on activities in science laboratory. Examples of such pictures are given below:

7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers

20 teachers (that involved NQTs and non-NQTs) were earmarked for the implementation of this Module of Chemical bonding, although only 17 teachers managed to participate in the implementation of the module. 17 teachers participated well in reading the module materials in the moodle platform, as well as attending almost all activities that were given in the moodle. The strategy that was mostly employed to encourage teachers' participation in the module implementation was to remind them by sending messages in telegram CoP as well as making phone calls through their personal phone numbers. The topic of Chemical bonding is normally taught in Form 2 according to Tanzania syllabus. Among the 17 teachers who were participating in the implementation of this module, several teachers were teaching other classes in their schools, other than Form 2 classes. In view of this scenario, we suggested to them that they liaise with their fellow teachers who are teaching Form 2 classes, to allow them teach the topic of Chemical bonding to Form 2 students. We are glad that this plan worked well.

B. Challenges

Implementation of Organic chemistry module faced several challenges including collision of schools' timetables with CL4STEM timetable of implementing the modules, mismatch between schools calendar and the CL4STEM schedule of implementing modules, some of the teachers who were involved in our CL4STEM program being assigned special academic assignments by their heads of schools or Ministry of Education which require them to work outside their schools premises etc.

C. Surprises

In Tanzania it was planned well in advance that the year 2022 was the year of census, which was planned to take place around mid 2022. This in a way impacted the timeframe of implementing our modules as a good number of teachers who were participating in CL4STEM program were involved in census activities.

D. Any changes required in the module design

Instead of using telegram as the only CoP platform, we suggest that additional platform of whatsapp be included in the communication.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre test and post test data
4. All teachers' lesson plans and reflections
5. Teachers' responses for the pre and post test surveys
6. Telegram CoP group data download for the during of the module
7. Grading Sheet

Subject : Physics

Energy, Work and Power

Authored by:
Prof. Paul Ikwaba and Mr. Yusuf Mhangwa

1. Introduction

A. Timeline of implementation in the country:

The course was covered in the weeks, starting from 4 July 2022 and ending up to 21 November 2022.

B. Learning objectives

The module intended to strengthen capacities in teaching of Work, Energy and Power in a competency based approach. Thus, the content in the module is divided into three main parts as follows: core content for teachers and students, PCK only for teachers and additional contents for both teachers and students.

C. Number of units

The module has three (3) units, each unit is organized into lessons; depend on the length of contents of the unit.For that case, the module consists of a total of eight (8) lessons and each lesson has been structured in such a way as to enable teachers to study it in one hour. Each lesson begins with a set of learning outcomes of what is expected when have   successfully completed the lesson.

For example, Unit 1, is the Energy, which has two lessons that is, Lesson One- Form of Energy, Lesson Two- Principles of Conservation of Energy. Unit 2: The work. This has three lessons which are Lesson 3- Mechanical work, Lesson 4- Work done by Electrical Energy and Lesson 5- Thermal Energy. Unit 3 has four units. The Power which has three Lessons, that is Lesson 6- Mechanical power, Lesson 7- Electrical power and Lesson 8- Thermal energy.

D. Concepts covered

i.   Different forms of energy (Kinetic and potential energy, Temperature, Sound, Light, Electric, Nuclear)
ii. What power means in each context

E. Resources - activities, readings

Lesson plans were done through module which is uploaded into moodle (e-learning Management system)

F. Nature and purpose of assessments

It is anticipated that by going through these modules teachers were able to reflect on their own ways of teaching physics, thereby thinking of better ways in which they may engage with their students in teaching other physics topics.

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Others	Total
1 - 20%	02	05	07
21 - 40%	00	00	00
41 - 60%	01	--	01
61 - 80%	01	01	02
81 - 100%	03	07	10
Total	07	13	20

Data in Table 1 depicts that the overall completion rate of 3 teachers ranged between 0% and 20%, whereas 17 teachers had the overall completion rate ranging from 81% to 100%.

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Others	Total
Pre test	08	11	19
Lesson plan 1	07	11	18
Lesson plan 2	07	11	18
Lesson plan 3	07	11	18
Module Reflection	07	11	18
Post tests	07	11	18

The table 2 above, shows where teachers completed assessment in the moodle platform during the study.

3. Time spent on the course platform

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Others	Total
Less than 10	05	08	13
10 to 20	03	03	06
21 to 30	----	----	----
More than 30	01	----	01
Total	09	11	20

The table 3 above, shows where teachers spend time in the moodle platform during the study

4. Change from pre- and post- test

Average total score in pre-test – 50.00%
Average total score in post-test – 61.11%

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice				
	26-50% Emerging		2	5	
	51-75% Proficient			6	3
	76-100% Accomplished				

Two NQTs (ID 2301 and ID 2311) did only pre-test, thus they are not included in Table 4.

Analysis of Table 4 indicates that about 31.3% of NQTs improved their performance from emerging to proficient after going through the materials in the module. Furthermore, about 18.8% of NQTs improved their performance from proficient to accomplish after studying the materials in Moodle. However, 12.5% and 37.5% of NTQs remained on emerging and proficient levels, respectively. This does not mean that there was no improvement in the performance to all NQTs in the post-test in these categories. The information implies that NQTs did not shift from one category to another. For example, a NQT who scored 53% in the pre-test and 73% in the post-test still will be graded under the same theme of proficient but he/she scored significantly in the post-test compared to pre-test. Taking this into considerations, it was found from the pre-test and post-test scores that four NQTs scored significantly higher in the pre-test compared to post-test (i.e., pre-test 60% and post-test 66%; pre-test 53% and post-test 73%; pre-test 60% and post-test 73%; pre-test 53% and post-test 73%). Generally, after NQTs have been trained using materials in module 1, majority (75%) of NQTs improved from emerging to proficient and proficient to accomplished levels. This signifies that the topic of 'Work, Energy and Power' can be well taught to Form II students using curated OER that has been contextualized in the Tanzanian learning environment.

5. Practice

	Number of teachers				Total
Criteria	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	0	9	9	18
2. Nature of Science/ Mathematics	0	0	10	8	18
B. Pedagogical Content Knowledge					
3. Instructional Strategies	0	2	13	3	18
4. Students' misconceptions & Learning Difficulties	0	5	13	0	18
5. Representation of the Content	0	0	8	10	18
6. Context for Learning	0	0	18	0	18
7. Curriculum knowledge	0	0	18	0	18
C. General Pedagogical Knowledge					
8. Equity and Inclusion	0	5	13	0	18
9. Classroom Management	0	0	14	4	18
10. Assessment	0	0	12	6	18
Total	0	12	128	40	180

A. Subject Matter Knowledge

Table 5 indicates all NQTs are either in the proficient or accomplished category. This implies that all NQTs have very good knowledge in the topic of 'Work, Energy and Power'. For example, from lesson plans, most NQTs demonstrated knowledge of interconnections between forms of energy and energy transformation as shown by example from one NQT lesson plan: *'Explain six forms of energy you know. Provide as many as possible examples of potential energy and kinetic energy in real life situations'.*

Another example demonstrating interconnections between sub-topics of energy is presented below from one NQT lesson plan: *'Discussing in a group of five students the meaning of energy transformation and provide your real life situations on how energy transformation takes place'.*

B. Pedagogical Content Knowledge

Table 5 indicates that the majority (99.2%) of NQTs are aware of PCK since 77.8% are in the proficient group while 14.4% are in the accomplished category. For example, most NQTs in their lesson plans prepared activities to identify students' misconceptions related to Work, Energy and Power. Two examples from NQTs lesson plans are:

i. *'I will start the lesson by testing the <u>prior knowledge of students</u> on the concept of conservation of energy through question and answer techniques so that I can identify the misconception and be able to connect to a new concept'.*

ii. *'First; I start brainstorming the students by asking the questions related to work done, form of energy and other concepts related to energy for the purpose of <u>recognizing what they know'.</u>*

C. General Pedagogical Knowledge

Table 5 shows that the majority (90.9%) of NQTs understand general pedagogical knowledge. This is demonstrated by the fact that about 72% of all NQTs understood the element of 'equity and inclusion' which requires teachers to provide equal opportunities to all students to participate in the classroom activities. For example, one NQT indicated in the lesson plan that 'I will ask students oral questions concerning the concept of force and each student to respond orally the questions asked'. In addition, all NQTs demonstrated understanding of classroom management and assessment. For example, one NQT indicated in the lesson plan that: 'I will provide exercise on the concept of motion to be done by each student in his or her exercise book'.

6. Social learning in CoPs

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	144
Teachers	28
Teacher Educators	57
Research fellow	37
Total	**266**

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	8
UDL	2
Technical	4
Communication/ Administrative	252
Total	**266**

Table 7.2: Frequency of posts by type

Type of post	Number of posts
Text only	246
Images	14
External Links to other resources	3
Others (pdf)	3
Total	**266**

C. Qualitative dialogues/ discussion threads

1. Message around PCK:

In this module (Work, Energy and Power), some NQTs shared experiences about PCK. In Figure 1, for example, NQT shared a question related to work done in Physics.
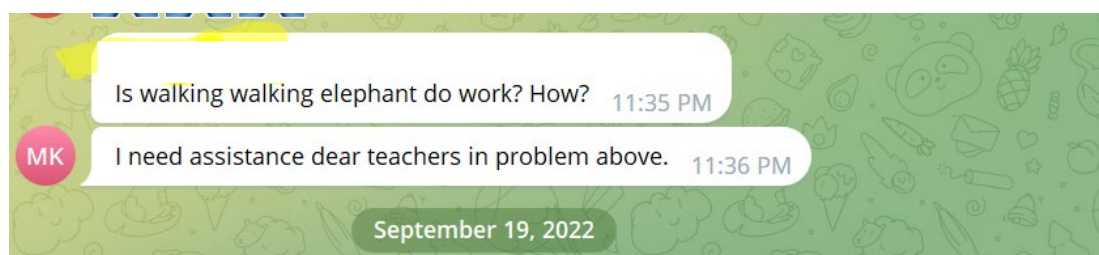
Figure 1: Message of around PCK

2. Sharing of Classroom Practices

In this module, NQTs shared good classroom practices. For example, in Figure 2(a), a teacher is demonstrating a concept using experiment while in Figure 2(b) students are engaged in group activities discussing issues related to transformation of energy.
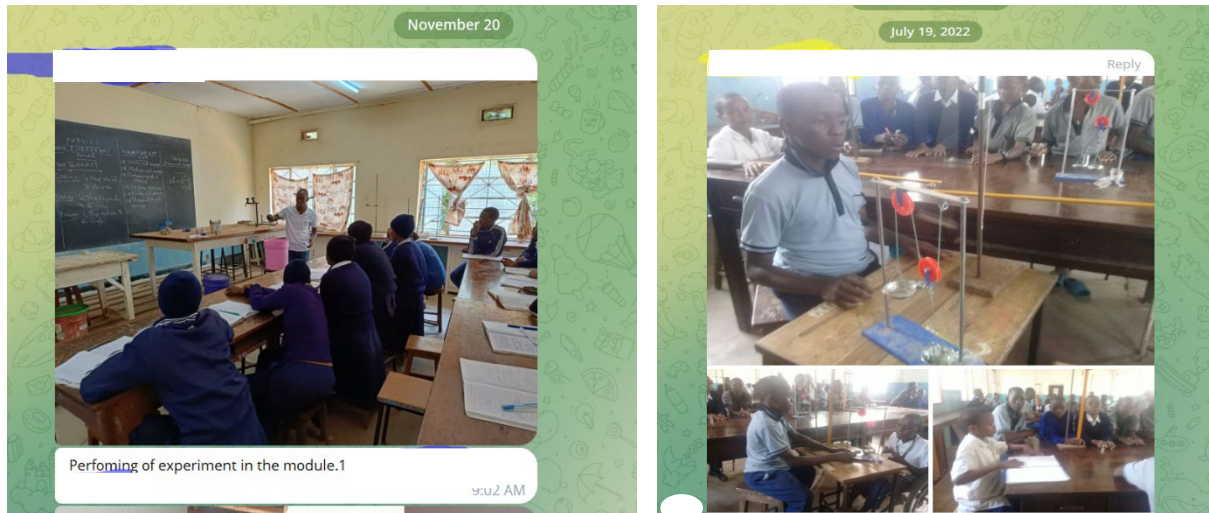
Figure 2(a): Teacher demonstrating a concept in a classroom

Figure 2(b): Teacher demonstrating a concept in a classroom

3. Responding to another NQT

Some NQTs requested assistance, although the topic was not part of Module 1 (Work, Energy and Power) as illustrated in Figure 3 where one NQT requested assistance on the question related to Kinetic friction. This implies that CoP is an important platform for Physics teachers in improving teaching and learning of Physics subjects.
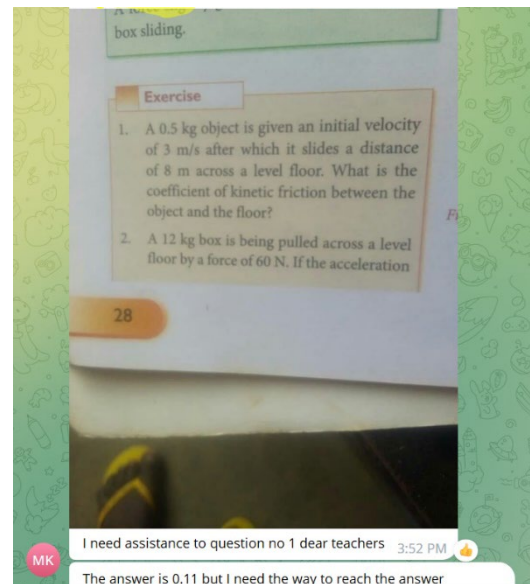
Figure 3(a): NQT requesting assistance on how to solve the question
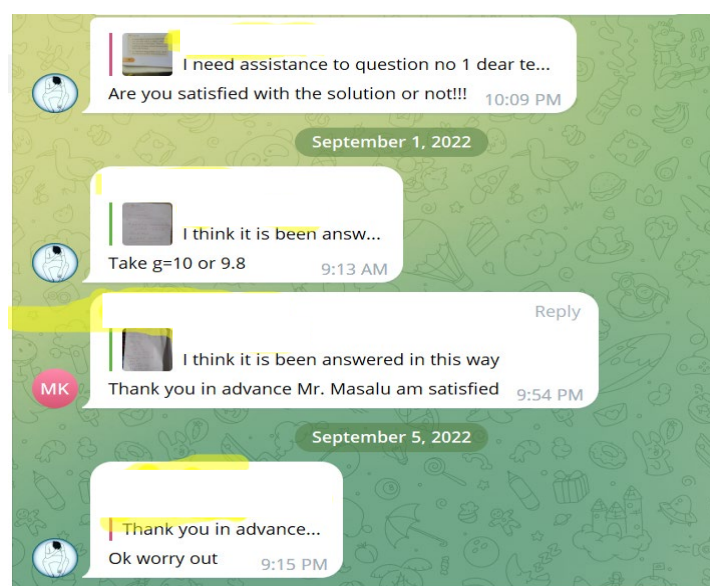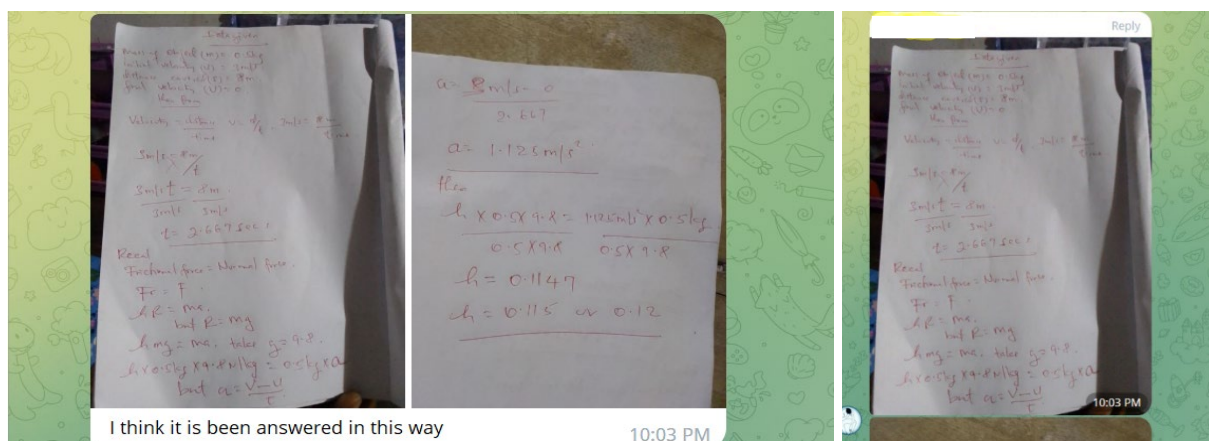
Figure 3(b): NQT provided clarification on how to solve the question.

4. NQTs Seeking Support from the TEs

In this module, some NQTs requested assistance from TEs related to materials in the Moodle. For example, one NQT requested to be assessed on the Moodle App as illustrated in Figure 4(a). Clarification for this request was provided as shown in Figure 4(b).
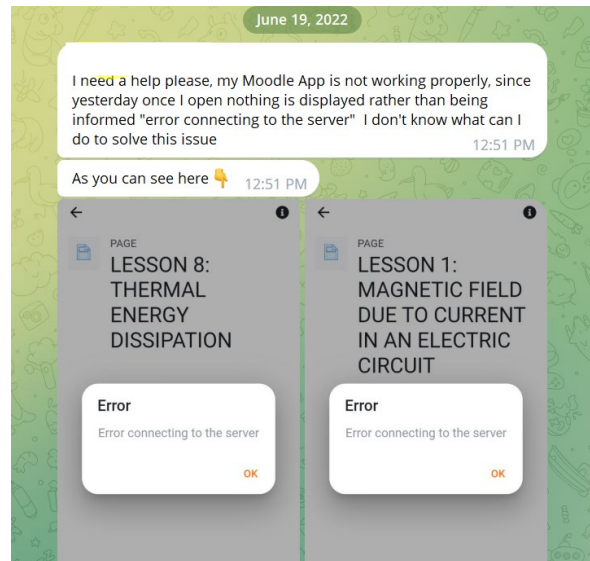
Figure 4(a): NQT requesting assistance from TEs
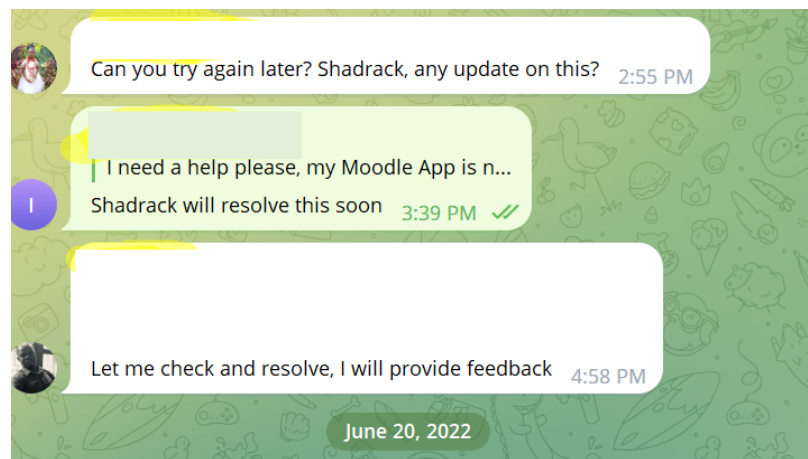
Figure 4(b): Response from TEs

7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers

i. In Moodle

In the Moodle, IT experts and TEs assisted NQTs to go through the materials and activities. This was important as most NQTs were able to implement some of the activities in the module into their classroom.

ii. In CoP

CoP in Physics module 1 was very important as TEs constantly kept the remaining NQTs on their roles and responsibilities in the project (Figure 5). This worked very well since the majority of the NQTs were able to complete module 1. In addition, various announcements were communicated through CoP. This was very important for the success of the project.

Figure 5: Teacher educator remaing NQTs to complete some activities in Physics modules

B. Challenges:

In Tanzania, Physics teachers have high teaching work load than other subjects, as a result, TEs had to send repetitive reminder to encourage NQTs to complete some activities on time and participate in CoP. In addition, internet connectivity was also a challenge with some NQTs since implementation of some activities in the classroom and accessing materials in Moodle required internet connectivity. Furthermore, CoP used Telegram while most NQTs and TEs in Tanzania frequently use WhatApp this might have limited the participation of NQTs and TEs in CoP. Access to technology infrastructure, specifically, laptop to some NQTs caused delays in completing some activities in Moodle. Moreover, teacher educators who have to work on the project in Moodle and CoP faced a challenge with time since TEs have also other have responsibilities at the University.

C. Surprises

i. Some NQTs did not share the photos for their classroom implementations.
ii. Two NQTs dropped from participating in this studying the materials in the module even after long discussions to motivate them to continue.

D. Any changes required in the module design:

For each topic, include PCK and details on how teachers can test prior knowledge of students. In addition, teachers have to implement only one activity from the module instead of three. This will allow teacher to have time and provide details on the lesson plan including preparation of teaching materials.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre test and post test data
4. All teachers' lesson plans and reflections
5. Teachers' responses for the pre and post test surveys
6. Telegram CoP group data download for the during of the module
7. Grading Sheet

Subject : Physics

Electromagnetism

Authored by:
Prof. Paul Ikwaba and Mr. Yusuf Mhangwa

1. Introduction

A. Timeline of implementation in the country:

The module two was starting from 22 November 2022 and ended up to 06 October 2022.

B. Learning objectives

This module intends to strengthen the capacities in teaching physics, specifically electromagnetism in a competency based approach. Thus, the content in the module is divided into three main parts as follows: core content for teachers and students, PCK only for teachers and additional contents for both teachers and students.

C. Number of units

The module is about electromagnetism and is organized into two (2) units. Magnetic field due to a current carrying conductor and Electromagnetic Induction.' Each unit is organized into Lessons, which are themselves subdivided into sub-topics. According to the Physics syllabus for Ordinary Level secondary schools in Tanzania (2017 edition), electromagnetism is taught in Form IV. The module has been developed by a Physics team from Bhutan. By then, the module was adopted by the PhysicsTanzania team [Prof. Paul Ikwaba and Mr. Pasvolo Mwinuka – The Open University of Tanzania.

D. Concepts covered

The concepts covered in unit 1 are: (a) Magnetic field due to current in an electric circuit (b) Magnetic field due to solenoid (c) Constructions of electromagnet (d) Direction of magnetic force on a current carrying conductor placed in a magnetic field and in unit 2 are : (a) Electromagnetic induction (b) applications of electromagnetic induction and (c) Transformers.

E. Resources - activities, readings

Lesson plans were done through module which is uploaded into moodle (e-learning Management system)

F. Nature and purpose of assessments

It seems that by going through this module 2, the teachers were able to perform activities on their own time and of teaching physics as applied to what they learned through moodle. Also thereby thinking of better ways in which they may engage with their students in teaching other physics topics.

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Others	Total
1 - 20%	--	--	--
21 - 40%	01	01	02
41 - 60%	--	--	--
61 - 80%	02	01	03
81 - 100%	04	09	13
Total	07	11	18

Table 1.1 above shows completion in the moodle platform during learning

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Others	Total
Pre test	07	11	18
Lesson plan 1	07	11	18
Lesson plan 2	07	11	18
Lesson plan 3	07	11	18
Module Reflection	07	11	18
Post tests	07	11	18

The table 2 above, above shows completion assessment in the moodle platform during learning

3. Time spent on the course platform

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Others	Total
Less than 10	06	11	17
10 to 20	01	--	01
21 to 30	----	----	----
More than 30		----	
Total	07	11	18

The table 3 above, shows time spend in the moodle platform during learning

4. Change from pre- and post- test

Average total score in pre-test- 44.81%
Average total score in post-test- 42.22%

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice		1		
	26-50% Emerging		6	2	
	51-75% Proficient		2	5	
	76-100% Accomplished				

Analysis of Table 4 indicates that, 1 teacher improved slightly from novice (0-25%) to emerging (26-50%), and 2 from emerging (26-50%) to proficient (51-75%), while 6 remain in emerging (26-50%) and 5 remain in proficient (51-76%), and none accomplished. 2 teachers regressed from Proficient (51-75%) to Emerging (26- 50%)

5. Practice

Table 5

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	---	--	16	2	18
2. Nature of Science/ Mathematics	--	--	17	1	18
B. Pedagogical Content Knowledge					
3. Instructional Strategies	--	--	17	1	18
4. Students' misconceptions & Learning Difficulties	--	9	9	---	18
5. Representation of the Content	--	--	16	2	18
6. Context for Learning	--	2	16	--	18
7. Curriculum knowledge	--	--	18	--	18
C. General Pedagogical Knowledge					
8. Equity and Inclusion	--	8	9	1	18
9. Classroom Management	--	--	18	--	18
10. Assessment	--	--	17	1	18
Total					

A. Subject Matter Knowledge

In this context, 88.8% of teacher's lesson plans and reflection were proficient and 11.2% met. None of the teacher's plans fall under novice or emerging. It seems that teachers are more competent in the subject matter knowledge got from that module. Examples: Magnetism produced by an electric current flowing in a wire. Teacher performed an experiment using materials such as Connecting wires, compass needle, iron filling, cardboard, and a source of electricity.

B. Pedagogical Content Knowledge

According to the data shown in table 5 above, found that, majority of the teachers are aware on PCK. because they fall under proficient (51-75%), very few fall under emerging (26-50%) and accomplished (76-100%), none found in novice.

C. General Pedagogical Knowledge

In this category, also majority of the teachers found in proficient (51-75%). Very few teachers fall under emerging and accomplished. None of novice found the general pedagogical knowledge.
Note: Refer to (5. Practice)

6. Social learning in CoPs

A. Frequency of posts

Table 6.1: Frequency of posts by participants

Role	Number of posts
NQTs	44
Teachers	13
Teacher Educators	43
Research fellow	00
Total	**100**

B. Frequency of posts

Table 5.2 : Frequency of posts by type

Type of post	Number of posts
Text only	77
Images	13
External Links to other resources	00
Others (pdf)	00
Total	**100**

C. Qualitative dialogues/ discussion threads

Actual the engagement in CoP, have made assistant in teaching and learning because has made the improvement of completion of module assignments and teachers gain knowledge while being completing to study the module to which before they are not clear. Picture below shows how learners interact during presentation of the lesson by the teacher.

The telegram image below, showed how TEs were using effort to encourage teachers to concentrate on teaching and learning their modules.
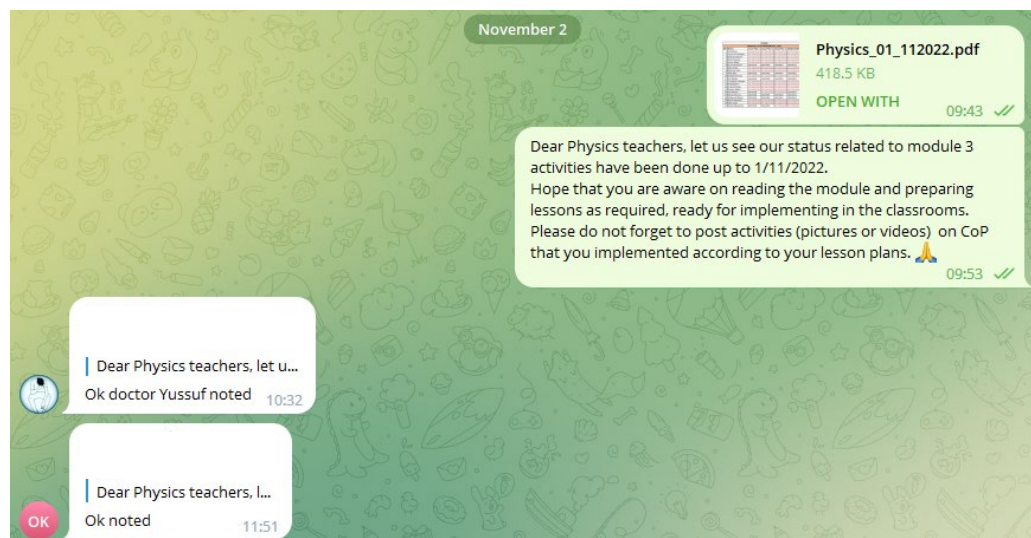
These are good examples because it shows the real situation of how TEs and Teachers were together, during teaching and learning.

7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers:

The use of Telegram, whatsapp, calling by phone, normal messages made majority of teachers participate well in Moodle.

B. Challenges:

Only a few teachers complained related to failure to get internet connectivity in some areas where their studying. Two teachers were not participated at all without any reasons. we tried to reach them by phones, messages, whatsap and telegram but were no good responses.

C. Surprises:

For each topic, include PCK and details on how teachers can test prior knowledge of students. In addition, teachers have to implement only one activity from the module instead of three. This will allow the teacher to have time and provide details on the lesson plan including preparation of teaching materials.

D. Any changes required in the module design:

No change for module two required.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre test and post test data
4. All teachers' lesson plans and reflections
5. Teachers' responses for the pre and post test surveys
6. Telegram CoP group data download for the during of the module
7. Grading Sheet

Subject : Physics

Force and Motion

Authored by:
Prof. Paul Ikwaba and Mr. Yusuf Mhangwa

1. Introduction

A. Timeline of implementation in the country:

The module two was, starting from 07 October 2022 and ended up to 21 November 2022.

B. Learning objectives

This module intends to strengthen the capacities in teaching physics, specifically Force and Motion in a competency based approach. Thus, the content in the module is divided into three main parts as follows: core content for teachers and students, PCK only for teachers and additional contents for both teachers and students.

C. Number of units

This module consists of two topics called 'Force and Motion'. The module has been developed by Physics team from Nigeria (Dr. Halliru Ibrahim, Dr. J Yabagi, Mr. Yusuf Abdullahi, Dr. Yusuf Tanko Usman, Dr. Idris Kawo) under the guidance of Tata Institute of Social Sciences (TISS) experts, India. The module was adopted by Physics Tanzania team (Dr. Paul Ikwaba and Mr. Pasvol Mwinuka – The Open University of Tanzania).The module is organized into Units and each unit is organized into Lessons, which are themselves subdivided into sub-topics. According to the Physics syllabus for Ordinary Level secondary schools in Tanzania (2017 edition), a topic called 'Force' is taught in Form I (topic number 4). In addition, a topic called 'Motion' is taught in Form II (topic number 6 – Motion in s straight line).

D. Concepts covered

The concepts covered in unit 1 is the concept of Motion, in Unit 2 Graphical representation of motion. Unit 3 types of Forces and Unit 4 Newton's Law of Motions.

E. Resources - activities, readings

Lesson plans were done through module which is uploaded into moodle (e-learning Management system)

F. Nature and purpose of assessments

It is seemed that by going through this module 3, the teachers were able to perform activities on their own time and of teaching physics as applied to whatnthey learned through moodle. Also there by thinking of better ways in which they may engage with their students in teaching other physics topics.

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Others	Total
1 - 20%	--	01	01
21 - 40%	--	--	--
41 - 60%	--	01	01
61 - 80%	01	01	02
81 - 100%	06	08	14
Total	07	11	18

Data in Table 1 shows where teachers completed in the moodle platform during the study

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Others	Total
Pre test	07	11	18
Lesson plan 1	07	11	18
Lesson plan 2	07	11	18
Lesson plan 3	07	11	18
Module Reflection	07	11	18
Post tests	07	11	18

The table 2 above, shows where teachers completed assessment in the moodle platform during the study

3. Time spent on the course platform

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Others	Total
Less than 10	07	09	16
10 to 20	----	01	01
21 to 30	----	01	01
More than 30	----	----	
Total	07	11	18

The table 3 above, shows where teachers time spend in the moodle platform during the study

4. Change from pre- and post- test

Average total score in pre-test – 42.22%
Average total score in post-test – 41.85%

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice	1	1		
	26-50% Emerging	1	9	1	
	51-75% Proficient		1	3	
	76-100% Accomplished				

One NQT (ID 2307) did only pre-test but did not do post-test, thus is not included in Table 4

Analysis of Table 3 indicates that about 17.6% of NQTs improved their performance from emerging level to proficient level after studying the materials through Moodle and participating in CoP. However, the majority (52.9%) of NTQs remained at an emerging level. Probably the main reason to explain this observation is that, due to large teaching load, most NQTs did not concentrate on studying and understanding various elements of the materials in the module.

5. Practice

Table 5

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	0	13	5	18
2. Nature of Science/ Mathematics	0	0	15	3	18
B. Pedagogical Content Knowledge					
3. Instructional Strategies	0	1	14	3	18
4. Students' misconceptions & Learning Difficulties	1	7	7	3	18
5. Representation of the Content	0	1	12	5	18
6. Context for Learning	1	4	9	4	18
7. Curriculum knowledge	0	5	10	3	18
C. General Pedagogical Knowledge					
8. Equity and Inclusion	0	6	9	3	18
9. Classroom Management	1	7	4	6	18
10. Assessment	0	1	15	2	18
Total					

A. Subject Matter Knowledge

Table 5(a) indicates that NQTs are either in the proficient or accomplished category. This implies that 100% of NQTs have very good knowledge in the topic of 'Force and Motion'. For example, from lesson plans, most NQTs demonstrated knowledge of interconnections in the sub-topic of forces as shown by example from one NQT lesson plan: 'In a group of five students, I will students to demonstrate real life examples of contact forces through the following activities: demonstrate friction force, air resistance force, normal force, applied force, and tension force'.

B. Pedagogical Content Knowledge

Generally, the majority (77.8%) of NQTs are aware of PCK since 57.8% are in the proficient group while 20% are in the accomplished category as shown in Table 5(b). For example, in the element of 'Representation of the Content', most (94.4%) of NQTs used multiple representations such as graphics, images and examples. For example, one NQT indicated in the lesson plan that 'Each student to demonstrate the concept of motion by measuring the distance of motion and recording the time by using tape measures and stopwatch'. Although PCK was generally achieved by most NQTs, the element of Students' Misconceptions & Learning Difficulties which is one the five elements of PCK was less (55.6%) addressed by NQTs as compared to other elements such as Instructional Strategies (94.4%), Representation of the Content (94.4%), Context for Learning (72.2%) and Curriculum knowledge (72.2%).

C. General Pedagogical Knowledge

Table 5(c) shows that majority (72.2%) of NQTs understand general pedagogical knowledge. This is demonstrated by the fact that about 67%, 55% and 94% of all NQTs understood the element of equity and inclusion, classroom management' and assessment, respectively. In the case of assessment, most NQTs (94.4%) used multiple modes of assessments (formative and diagnostic) to support higher order thinking. For example, one NQT indicated in the lesson plan that 'homework will be given to students as an exercise to evaluate students' progress on the concept of types of forces'.

6. Social learning in CoPs

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	84
Teachers	55
Teacher Educators	77
Research fellow	9
Total	225

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	13
UDL	9
Technical	3
Communication/ Administrative	200
Total	**225**

Table 7.2: Frequency of posts by type

Type of post	Number of posts
Text only	191
Images	23
External Links to other resources	0
Others (pdf)	11
Total	**225**

C. Qualitative dialogues/ discussion threads

1. Sharing of Classroom Practices

In Module 3, most NQTs shared good classroom photos when implementing some activities from module in their classroom. This is demonstrated in Figure 1(a) where students are in groups doing activities related to types of forces while in Figure 1(b) students are in Physics laboratory concentrating on the blackboard where a teacher is demonstrating a certain concept.

Figure 1(a): Students on group work activities

Figure 1(b):Students in the Physics laboratory performing group work activity

2. Responding to another NQT

Some NQTs requested assistance, for example, one NQT requested information regarding interpretation of content of the video which was imbedded in the materials of the module (Figure 2a). Clarification for this request was providing by another NQT as indicated in Figure 2(b). In addition, some NQTs requested assistance on the topics which were not part of Module 3 (Force and Motion) as illustrated in Figure 2(c).
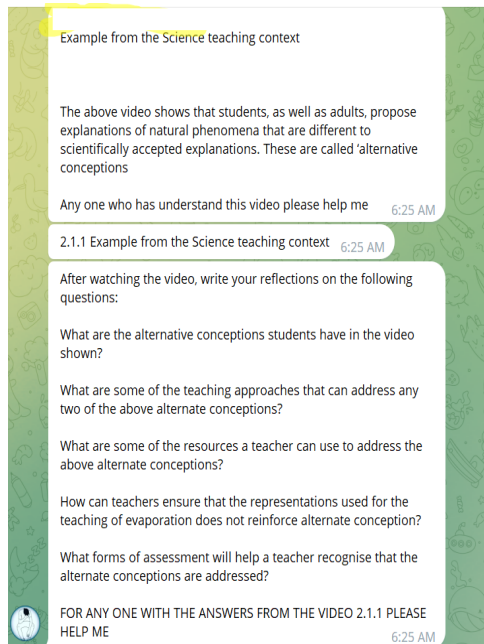
Figure 2(a): NQT requesting clarification of video contents
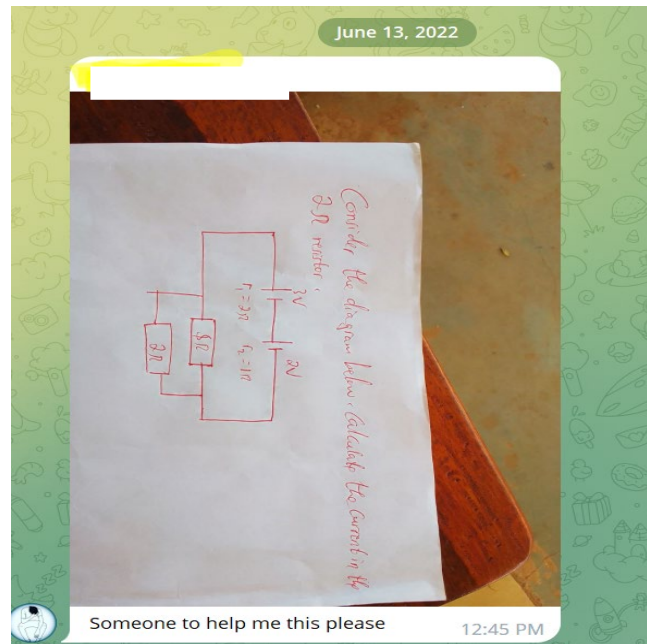
Figure 2(b): Clarification on the content of the video in the module

3. NQTs Seeking Support from the TEs

In this module, some NQTs requested assistance from TEs related to materials in the Moodle. For example, one NQT requested to be assessed on the Moodle App as illustrated in Figure 3(a). Clarification for this request was provided as shown in Figure 3(b).
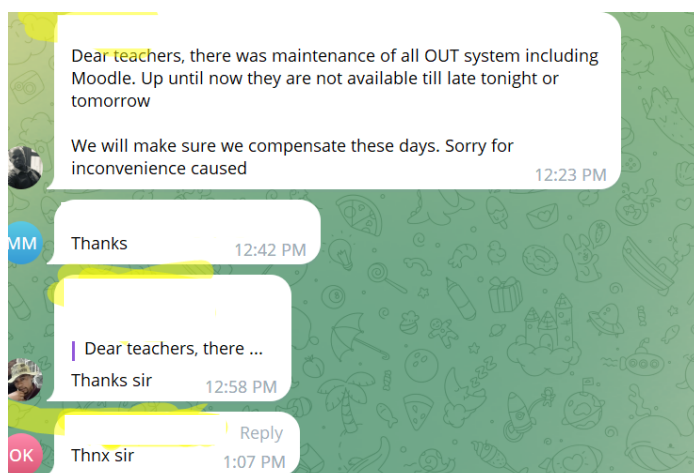
Figure 3(a): NQT requesting assistance from TEs
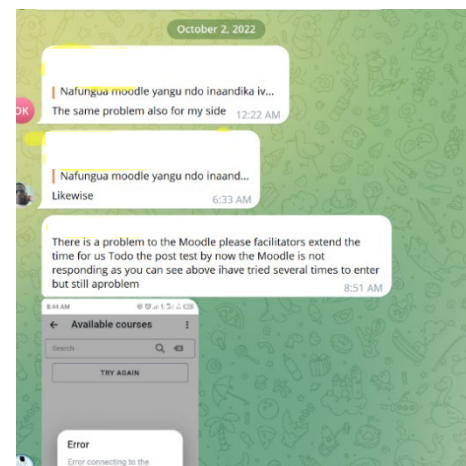
Figure 3(b): TE clarification on of issue raised by NQT

7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers

i. In Moodle

In the Moodle, IT expert and TEs assisted NQTs to study the material related to the concept of force and motion including on how to upload lesson plans and reflections. This was important as most NQTs were able to implement all the required activities related to the topic of Force and Motion.

ii. In CoP

CoP in Physics module 3 was very important as TEs constantly kept remaining NQTs on their roles and responsibilities in the project. For example, one TE emphasized NTQs to submit lesson plans and reflection for Module 3 as illustrated the screenshot in Figure 4. This kind of interaction was very usefully in the completion of all activities in Module 3.
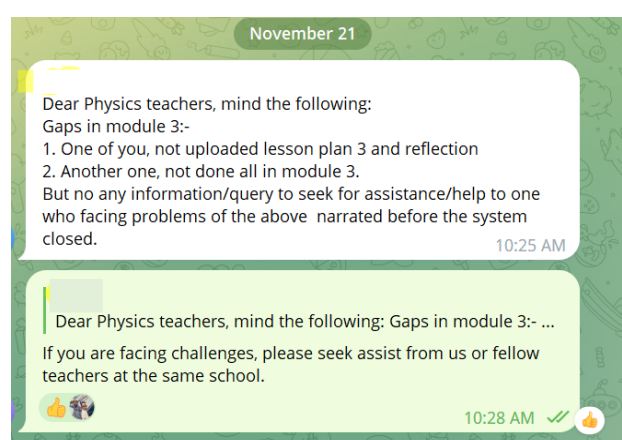
Figure 4: Teacher educator asking NQTs to complete some activities in Module 3.

B. Challenges:

In Tanzania, due to shortage of science, Physics teachers have higher teaching work load compared to Arts subjects, as a result, TEs had to send repetitive reminder to encourage NQTs to complete some activities on time and participate in CoP. In addition, internet connectivity was also a challenge with some NQTs since implementation of some activities in the classroom and accessing materials in Moodle required internet connectivity. Furthermore, CoP used Telegram while most NQTs and TEs in Tanzania frequently use WhatApp this might have limited the participation of NQTs and TEs in CoP. Access to technology infrastructure, specifically, laptop to some NQTs caused delays in completing some activities in Moodle. Moreover, teacher educators who have to work on the project in Moodle and CoP faced a challenge with time since TEs have also other have responsibilities at the University.

C. Surprises

i. Two NQTs dropped from participating in this studying the materials in the module even after long discussions to motivate them to continue.
ii. Analysis of pre-test and post-test indicated that one NQT dropped from emerging level to novice level while another NQT dropped from proficient category to emerging category.

D. Any changes required in the module design:

The module has to emphasize on PCK for each sub-topic and provides details on how students' misconceptions can be address by teachers. In addition, each teacher should to implement only one activity from the module instead of three lessons. This will allow teachers to have enough time in the preparation of the lesson plan including preparation of teaching materials.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre test and post test data
4. All teachers' lesson plans and reflections
5. Teachers' responses for the pre and post test surveys
6. Telegram CoP group data download for the during of the module
7. Grading Sheet

Subject : Mathematics

Proportions and Percentages

Authored by:
Dr. Seleman Ismail, Mr. Mustapha Kiswanya
and Mr. Michael Peter

1. Introduction

T his module targets fresh teachers' graduates as its main participants, preparing them to teach this particular area for form one students. We considered Tanzania's basic mathematics syllabus, the needs of school teachers revealed through a quick survey, relevance to partners' countries, duration, and logical flow of the content ideas when selecting and deciding the contents for the module. As for proportion and percentage, we provide the following description:-

A. Timeline of implementation in the country:

The course covered from 4th July, 2022 to 21st Sept, 2022

B. Learning objectives

i. Identify the key concepts and ideas needed to strengthen students understanding of proportions and percentages
ii. Identify the key concepts and ideas needed to understand equivalent fractions.
iii. Identify, recognize and understand parts and whole both visually and numerically.
iv. To develop students' capacity on proportional reasoning on interconnected ideas and objects.
v. To connect proportions and percentages and understand how they are related to each other.
vi. To use and connect different representations for representing proportional situations.
vii. Connect proportional representation with real life situations.

C. Number of units

Number of units for this module were four namely

i. Prior Knowledge of Ratios
ii. Percentage
iii. Commercials Maths I
iv. Commercial Maths II

D. Concepts covered

i. Brief concepts on ratios
ii. Applications of proportions in solving percentage problems
iii. Application of commercial maths in real scenarios

E. Resources - activities, readings

The module were covered through Moodle eLearning Management System. Hands on activities, were given so that NQTs have opportunities to understand the content and the pedagogy associated with it

F. Nature and purpose of assessments

The course involved a Pre-test held at the beginning of the module, one reflection exercise, three lesson plans, and a Post-test at the end.

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Non NQTs	Total
1 - 20%	2	2	4
21 - 40%	0	0	0
41 - 60%	0	0	0
61 - 80%	1	0	1
81 - 100%	2	13	15
Total	5	15	20

From table above (Table 1) four teachers ranging from 1-20% of performance dropped out after participating in few activities, while one teacher ranged in the interval of 61-80% performance. Fifteen teachers fully completed the module with completion rates ranging from 81-100%. Altogether, sixteen participants completed the course successfully.

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Non NQTs	Total
Pre test	3	13	16
Session plans	3	13	16
Reflection	3	13	16
Post tests	3	13	16

From Table 2, 16 out of 20 teachers completed all the assessments. This was 3 out of 5 NQTs and 13 out 15 NonNQTs. This implies that 80% of all teachers involved in the modules participated fully.

3. Time spent on the course platform

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Others	Total
Less than 10	11	2	13
10 to 20	2	1	3
21 to 30	0	0	0
More than 30	0	0	0
Total	13	3	16

4. Change from pre- and post- test

Average total score in pre-test - 4.71 out of 10
Average total score in post-test - 4.86 out of 10

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice				
	26-50% Emerging	1	3	5	
	51-75% Proficient	1	1	4	1
	76-100% Accomplished				

From the above table (Table 4) five NQTs moved from emerging (26-50%) to proficient (51-75%), one moved from proficient (51-75%) to accomplished (76-100%), three regressed from emerging (26-50%) to novice (0-25%), three remained at emerging level (26-50%), and four remained at proficient level (51-75%).

5. Practice

Table 5

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	0	14	2	16
2. Nature of Science/ Mathematics	0	0	16	0	16
B. Pedagogical Content Knowledge					
3. Instructional Strategies	0	1	10	5	16
4. Students' misconceptions & Learning Difficulties	0	4	11	1	16
5. Representation of the Content	0	3	10	3	16
6. Context for Learning	0	1	15	0	16
7. Curriculum knowledge	0	0	16	0	16
C. General Pedagogical Knowledge					
8. Equity and Inclusion	0	0	16	0	16
9. Classroom Management	0	0	15	1	16
10. Assessment	0	0	16	0	16
Total	0	9	139	12	160

A. Subject Matter Knowledge

The participants seem to have both good subject matter knowledge and nature of mathematics as discovered in their lesson plans and reflections. Table 5 demonstrated that 14 out of 16 teachers have a proficient level of subject matter knowledge, while 2 of them demonstrate and accomplished level. All 16 teachers demonstrate a proficient level of understanding of the nature of mathematics. One example is teacher's lesson plan that linked fractions, decimals, and ratios together. This is evident from the following quote "Relate fraction and decimal to a ratio as a part-whole and part-part- whole relationship" This shows a good understanding of the subject matter.

B. Pedagogical Content Knowledge

Majority of the participants are aware of PCK, it was observed that most of them were in the proficient level as they were able to incorporate creative activities in their lesson plans to make learning more engaging for better student outcomes. One activity in this aspect were to lead students to "convert the shaded part of rectangle to fraction, decimal and percentage". For example the teacher created the following table so that student can work in it.

xxxxxxxxxx		
xxxxxxxxxx	xxxxxxxxxx	xxxxxxxxxx
		xxxxxxxxxx
	xxxxxxxxxx	

C. General Pedagogical Knowledge

Except one participant who were in the accomplished level, rest of the participants fall under proficient category in the general pedagogical knowledge. For example in the aspect of assessment they some teachers used games in teaching. This were evident from one teacher in her lesson plan she provided a game on "matching fractions, decimals and percentages" using the Table C below

Table C			
0.5	25%	9/10	80%
30%	3/5	0.8	0.6
0.9	1/100	2/5	1/2
1%	0.3	1/4	0.4

6. Social learning in CoPs

The NQTs participation in the Telegram group is good. They just present several issues and get assisted by TEs and Technician as shown in the table below

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	26
Teachers	139
Teacher Educators	68
Research fellow	38
Total	**271**

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	38
UDL	5
Technical	4
Communication/ Administrative	224
Total	**271**

Table 7.2: Frequency of posts by type

Type of post	Number of posts
Text only	217
Images	26
External Links to other resources	3
Others (pdf)	25
Total	**271**

C. Qualitative dialogues/ discussion threads

1. Here is an example of a help sought by the NQT teacher from one of the schools, she were asking "How can you use a double number line to find the 20% percent of other number which is greater than 100?" Later other NQTs responded as shown in the screenshot
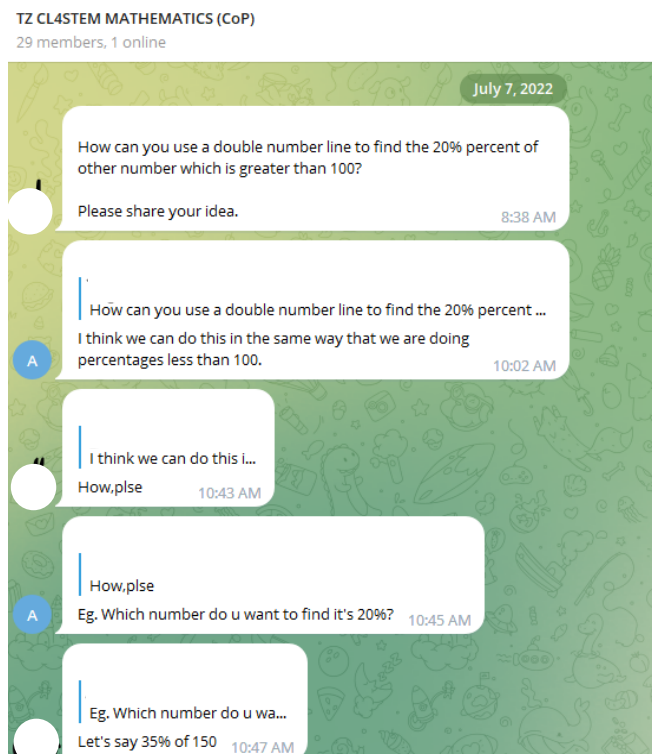
2. The discussion continued later as more NQTs were curious to see in details about what has been asked. Then they requested someone to present in a piece of paper as shown in the picture below
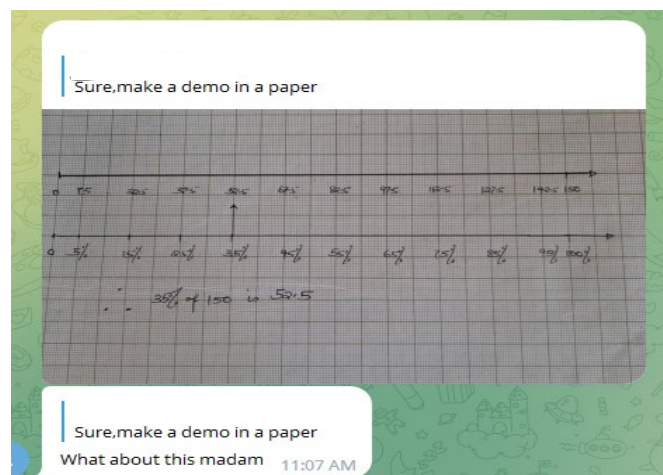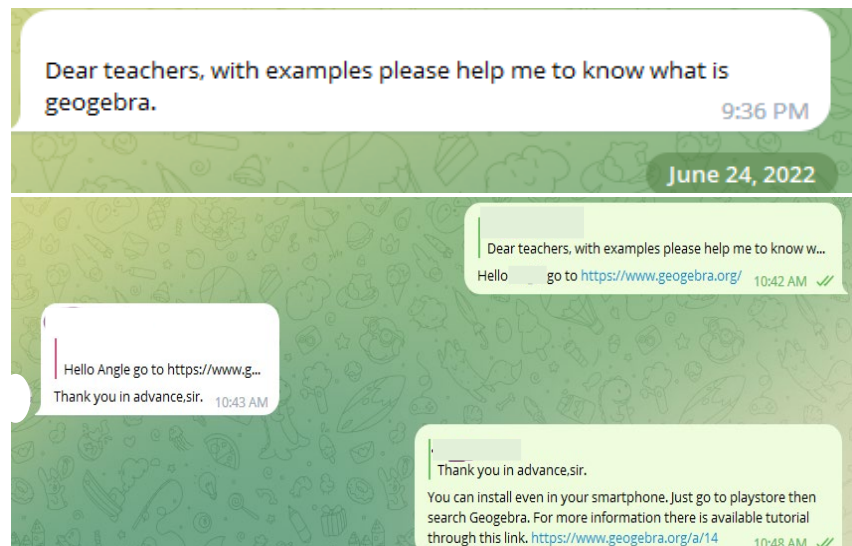

3. Extension of the learning: At last TE responded to the discussion by providing a link to assist teachers on the particular concept about proportions and percentage as shown in the screen shot below
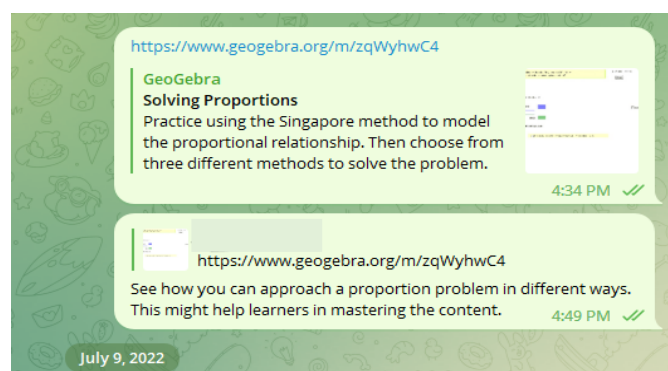
7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers:

Majority of NQTs were cooperative in Moodle as well as in Telegram, as they were asked questions for clarifications in this module. They also posted some pictures in live sessions when teaching. An example is shown next:

B. Challenges:

Some teachers were not cooperative despite of being called frequently. About 4 NQTs didn't do anything in the course. TE tried to encourage them but nothing changed in terms of participation in the project. Evidence is as shown in the screenshot below where a TE was reminding NQTs

C. Surprises:

Teachers after attending a workshop and oriented on how to go through the module, four out of twenty teachers did not show any progress on the module. They all disappeared afterwards.

D. Any changes required in the module design:

May be to improve active participation of teachers in the module we may include even WhatsApp not only telegram as a means of reaching teachers.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre-test and post test data
4. Teachers' responses for the pre and post-test surveys
5. Lesson plans and reflections data
6. Grade-Sheet

Subject : Mathematics

Algebra

Authored by:
Dr. Seleman Ismail, Mr. Mustapha Kiswanya
and Mr. Michael Peter

1. Introduction

T his module targets fresh teachers' graduates as its main participants, preparing them to teach this particular algebra for form one students. We considered Tanzania's basic mathematics syllabus, the needs of school teachers revealed through a quick survey, relevance to partners' countries, duration, and logical flow of the content ideas when selecting and deciding the contents for the module. As for algebra module, we provide the following description

A. Timeline of implementation in the country:

The course covered from 22nd Sept, 2022 to 6th October, 2022

B. Learning objectives

i.   Be able to learn about and remember the important pedagogical pillars and student misconceptions while teaching simple equations, linear inequalities and simultaneous equations

ii.   Be able to understand the various misconceptions that the students have and the pedagogical practices that must be utilized inside the classrooms; and thereby outline these misconceptions and pedagogical pillars in their own words

iii.   Be able to apply the concepts learnt in the module in their own practice by creating and executing lessons based on the principles learnt in the module

iv.   Be able to evaluate their own lesson plans and execution of the principles outlined in the module via self reflection templates

v.   Be able to create lesson plans and assessments to incorporate the learning from the module.

C. Concepts covered

i.   Simple Equations
ii.   Inequalities in one variable
iii.   Simultaneous equations
iv.   Forming linear equations
v.   Solving equations in 1 variable
vi.   Solving equations using models
vii.   Solving equations using Guess and Test
viii. Solving equations using inverse operations
ix.   Checking answers to equations

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Others	Total
1 - 20%	2	2	4
21 - 40%	0	0	0
41 - 60%	0	0	0
61 - 80%	1	0	1
81 - 100%	2	13	15
Total	5	15	20

From Table 1, four teachers ranging from 1-20% of performance dropped out after participating in few activities, while one teacher ranged in the interval of 61-80% performance. Fifteen teachers fully completed the module with completion rates ranging from 81-100%. Altogether, sixteen participants completed the course successfully.

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Others	Total
Pre test	13	3	16
Session plans	13	3	16
Reflection	13	3	16
Post tests	13	3	16

From Table 2, 16 out of 20 teachers completed all the assessments. This was 3 out of 5 NQTs and 13 out 15 NonNQTs. This implies that 80% of all teachers involved in the modules participated fully.

3. Time spent on the course platform

14 teachers spent less than 10 hours in the Moodle platform, and 2 spent between 10 to 20 hours. This implies that about 87.5% of the teachers spent less than 10 hours in the Moodle platform while 12.5% spent between 10 to 20 hours.

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Others	Total
Less than 10	3	11	14
10 to 20	2	0	2
21 to 30	0	0	0
More than 30	0	0	0
Total	5	11	16

4. Change from pre- and post- test

Average total score in pre-test 4.65 out of 10
Average total score in post-test 5.19 out of 10

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice		1		
	26-50% Emerging		8	4	
	51-75% Proficient		1	2	
	76-100% Accomplished				

From the above table (Table 4) one NQT showed slow improvement from Novice (0-25%) to emerging (26-50%), while eight NQTs remained in the same level of (26-50%) and two NQTs stayed at proficient (51-75%). Four NQTs improved from emerging (26-50%) to proficient (51-75%), but one NQT dropped from proficient (51-75%) to emerging (26-50%)

5. Practice

Table 5

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	0	6	10	16
2. Nature of Science/ Mathematics	0	0	12	4	16
B. Pedagogical Content Knowledge					
3. Instructional Strategies	0	2	9	5	16
4. Students' misconceptions & Learning Difficulties	0	14	1	1	16
5. Representation of the Content	0	2	12	2	16
6. Context for Learning	0	0	15	1	16
7. Curriculum knowledge	0	1	15	0	16
C. General Pedagogical Knowledge					
8. Equity and Inclusion	0	1	14	1	16
9. Classroom Management	0	0	13	3	16
10. Assessment	0	1	14	1	16
Total	0	21	111	28	160

A. Subject Matter Knowledge

The participants seem to have both good subject matter knowledge and nature of mathematics as discovered in their lesson plans and reflections. Table 5 demonstrated that 6 out of 16 teachers have a proficient level of subject matter knowledge, while 10 of them were in the accomplished level. Out of 16 teachers, 12 were in the proficient level of understanding of the nature of mathematics while 4 were in the accomplishment.

An example that justify that a good number of teacher in this aspect were in good level is evidenced from one example from one of the lesson plan whereby a teacher was trying to link between two concept as quoted below where teacher wrote in her lesson plan

> *"-Equations and inequalities are both mathematical sentences that relate two expressions to each other*
> *-An equation or an equality that contains at least one variable is called an open sentence."*

From this extract it justify that the teacher had good understanding of the subject matter.

B. Pedagogical Content Knowledge

From Table 5, We saw that the majority of both NQTs and NonNQTs were aware of PCK, it was observed that most of them were at the proficient level as they were able to incorporate creative activities in their lesson plans to make learning more engaging for better student outcomes. Nevertheless the majority failed to handle students' misconceptions as we see that about 14 were in the emerging level and only 2 were good at handling misconceptions.

For example one teacher were able to discover some misconception as she described in the following two sentences

> i. *Some students translate that -4 is less than -7 ie -4 < -7 instead -7<-4 this will be addressed by using concepts of number line and integers.*
> ii. *Some students may inappropriately translate five subtracted from b as (5 – b) instead of (b – 5). To address this, teacher should reverse the standard used in translating sentences into algebraic expression.*

C. General Pedagogical Knowledge

Except two participant who were in the emerging level, rest of them the participants fall under proficient and accomplished category in the general pedagogical knowledge. For example in the aspect of assessment a certain teacher said in the main teaching point part in the lesson plan that *"Sudoku "inequalities" game will be on the paper."* This will help learners to understand the lesson easily and make them be creative.

6. Social learning in CoPs

The NQTs participation in the Telegram group is good. They just present several issues and get assisted by TEs and Technician as shown in the table below

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	8
Teachers	63
Teacher Educators	39
Research fellow	0
Total	**110**

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	12
UDL	7
Technical	4
Communication/ Administrative	87
Total	**110**

Table 7.2: Frequency of posts by type

Type of post	Number of posts
Text only	79
Images	16
External Links to other resources	0
Others (pdf)	15
Total	**110**

C. Qualitative dialogues/ discussion threads

1. In this aspect teacher were posting some of their live session for example one teacher posted about the SUDOKU game as shown.
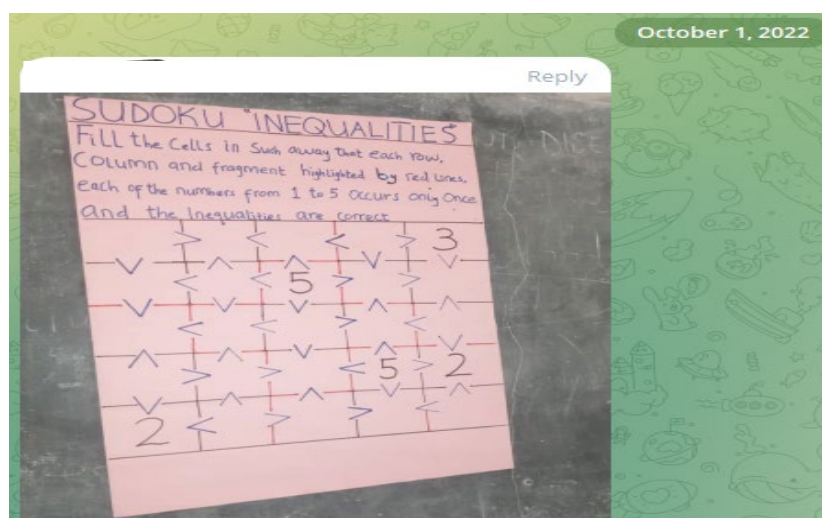
2. A follow up encouragement work from TE team followed to encourage other teacher to post their live class session as in the post below.
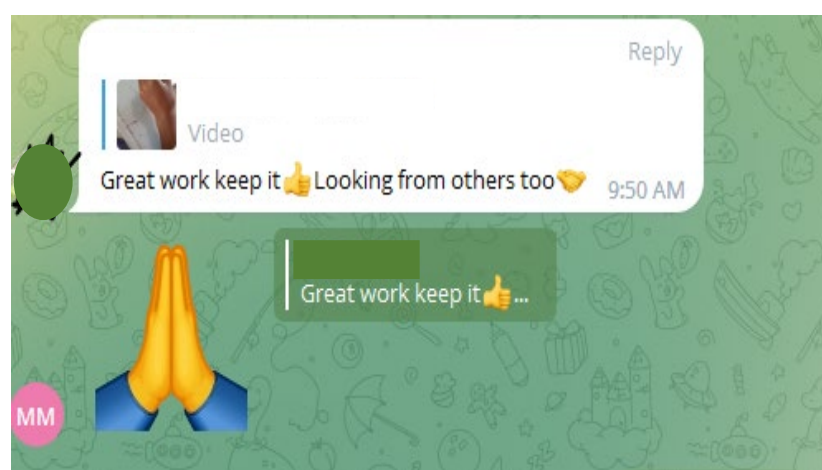
3. Extension of the learning: The TE just provided a link for GeoGebra that can assist teacher in implementing algebra module
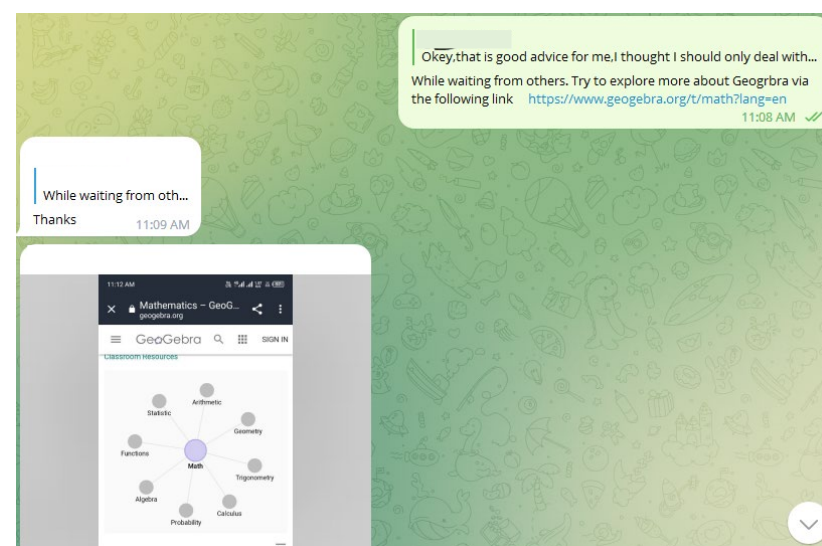
7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers:

Majority of NQTs were cooperative in Moodle as well as in Telegram, as they were ask questions for clarifications in this modules. They also post some pictures in live sessions when teaching. Also, the aspect of equity and inclusion were observed in some schools for example the following picture shows inclusion of students with disability and those who are normal in one class.

B. Challenges:

Some teachers were not cooperative despite of being called frequently. About 4 NQTs didn't do anything in the course. TE tried to encourage though phone calls, text message but nothing changed in terms of

participation in the project. Evidence is as shown in the screenshot below where a TE was reminding NQTs

C. Surprises:

Teachers after attending a workshop and oriented on how to go through the module, four out of twenty teachers did not show any progress on the module. They all disappeared afterwards.

D. Any changes required in the module design:

May be to improve active participation of teachers in the module we may include even WhatsApp not only telegram as a means of reaching teachers.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre-test and post test data
4. Teachers' responses for the pre and post-test surveys
5. Lesson plans and reflections data

Subject : Mathematics

Geometry: Area, Perimeter, and Transformation

Authored by:
Dr. Seleman Ismail, Mr. Mustapha Kiswanya
and Mr. Michael Peter

1. Introduction

T his module targets fresh teachers' graduates as its main participants, preparing them to teach this particular Geometry module for form one students. We considered Tanzania's basic mathematics syllabus, the needs of school teachers revealed through a quick survey, relevance to partners' countries, duration, and logical flow of the content ideas when selecting and deciding the contents for the module. As for algebra module, we provide the following description

A. Timeline of implementation in the country:

The course covered from 7th Oct. 2022 to 21st Nov. 2022

B. Learning objectives

i. Understanding the concept of area and perimeter
ii. Conservation of area
iii. Units for the area and for perimeter
iv. Understanding the variant and invariant properties of area and perimeter
v. Transformation and its effect on the shape and its measurements
vi. Special quadrilaterals (formula derivation)
vii. Misconceptions and difficulties students face while engaging with the following concepts or sub-concept

C. Number of units

The module composed of four units namely

i. Measuring units
ii. Perimeter and its scope (dimension)
iii. Area and its scope
iv. Relationship between the two measurements (area and for perimeter)- classroom- examples

D. Concepts covered

i. Defining Units
ii. Standard and non-standard units
iii. Perimeter (define) and formula
iv. Area (define) and formula
v. Transformations
vi. Variant and invariant properties
vii. Relationship between area and perimeter
viii. Special cases
ix. Contextual examples

E. Resources - activities, readings

i. The modules were covered through Moodle eLearning Management System.
ii. Hands on activities, were given so that NQTs have opportunities to understand the content and the pedagogy associated with it

Nature and purpose of assessments

The course involved a Pre-test held at the beginning of the module, reflection exercise, three lesson plans, and a Post-test at the end.

2. Course completion rate

A. Overall completion

Table 1: Course completion rate by teachers

	NQTs	Others	Total
1 - 20%	2	2	4
21 - 40%	0	0	0
41 - 60%	0	0	0
61 - 80%	1	0	1
81 - 100%	2	13	15
Total	5	15	20

From Table 1, four teachers ranging from 1-20% of performance dropped out after participating in few activities, while one teacher ranged in the interval of 61-80% performance. Fifteen teachers fully completed the module with completion rates ranging from 81-100%. Altogether, sixteen participants completed the course successfully.

B. Assessment completion rate

Table 2: Teachers' assessment completion rate

	NQTs	Others	Total
Pre test	13	3	16
Session plans	13	3	16
Reflection	13	3	16
Post tests	13	3	16

From Table 2, 16 out of 20 teachers completed all the assessments. This was 3 out of 5 NQTs and 13 out 15 NonNQTs. This implies that 80% of all teachers involved in the modules participated fully.

3. Time spent on the course platform

14 teachers spent less than 10 hours in the Moodle platform, and 2 spent between 10 to 20 hours. This implies that about 87.5% of the teachers spent less than 10 hours in the Moodle platform while 12.5% spent between 10 to 20 hours.

Table 3: Time spent by teachers on Moodle platform

Hours spent	NQTs	Others	Total
Less than 10	1	13	**14**
10 to 20	2	0	**2**
21 to 30	0	0	**0**
More than 30	0	0	**0**
Total	**3**	**13**	**16**

4. Change from pre- and post- test

Average total score in pre-test 3.22 out of 10
Average total score in post-test 5.59 out of 10

Table 4

Number of teachers		Post Test			
		Novice 0-25%	Emerging 26-50%	Proficient 51-75%	Accomplished 76-100%
Pre test	0-25% Novice	1	2	1	
	26-50% Emerging		2	7	2
	51-75% Proficient				1
	76-100% Accomplished				

From the above table (Table 4) one NQT remained at Novice level(0-25%), two NQTs slowly progressed from Novice to emerging, one NQT progressed from Novice to Proficient, two NQTs stayed at emerging level, seven NQTs progressed from emerging to proficient, two NQTs moved from emerging to accomplished, and one NQT moved from proficient to accomplished level.

5. Practice

Table 5

Criteria	Number of teachers				Total
	Novice	Emerging	Proficient	Accomplished	
A. Subject Matter Knowledge					
1. Knowledge of Subject Matter	0	0	2	14	**16**
2. Nature of Science/ Mathematics	4	2	8	2	**16**
B. Pedagogical Content Knowledge					
3. Instructional Strategies	2	2	9	3	**16**
4. Students' misconceptions & Learning Difficulties	5	4	4	3	**16**
5. Representation of the Content	1	0	9	6	**16**
6. Context for Learning	2	3	6	5	**16**
7. Curriculum knowledge	1	0	9	6	**16**
C. General Pedagogical Knowledge					
8. Equity and Inclusion	3	3	3	7	**16**
9. Classroom Management	1	2	3	10	**16**
10. Assessment	0	0	7	9	**16**
Total	19	16	60	65	**160**

A. Subject Matter Knowledge

The participants seem to have good subject matter knowledge as discovered in their lesson plans and reflections. Table 5 demonstrated that 2 out of 16 teachers were in the proficient level of subject matter knowledge, while 14 of them were in the accomplished level. In the nature of mathematics aspect most of the teacher were not good as 4 were in novice, 2 in emerging, 8 in the proficient, and only 2 teacher were in the accomplished level.

B. Pedagogical Content Knowledge

From Table 5 We saw that majority of both NQTs and NonNQTs were aware of PCK, it was observed that most of them were in the proficient level as they were able to incorporate creative activities in their lesson plans to make learning more engaging for better student outcomes. Nevertheless majority failed to handle students' misconception as we see that about 14 were in the emerging level and only 2 were good at handling misconceptions. The other aspect in this section were properly covered.

C. General Pedagogical Knowledge

Except in the aspect of equity and inclusion the other part of in this section were well addressed by teachers. For example 13 out of 16 were in good level in classroom management. Also in the assessment part in this section 16 (7 proficient level, 9 accomplishment level) were good in the general pedagogical knowledge. One teacher were able to mention a link as statement quoted *"As a part of warm-up activity for the lesson, the teacher will play the video song below* https://www.youtube.com/watch?v=hFajxpVeobY *twice and ask questions as mentioned in the warm up section"*. This fit in the aspect of assessment in this section.

6. Social learning in CoPs

The NQTs participation in the Telegram group is good. They just present several issues and get assisted by TEs and Technician as shown in the table below

A. Frequency of posts

Table 6: Frequency of posts by participants

Role	Number of posts
NQTs	10
Teachers	102
Teacher Educators	124
Research fellow	8
Total	**244**

B. Frequency of posts

Table 7.1: Frequency of posts by content

Type of Posts	Number of posts
PCK	23
UDL	2
Technical	3
Communication/ Administrative	216
Total	**244**

Table 7.2: Frequency of posts by type

Type of post	Number of posts
Text only	198
Images	23
External Links to other resources	3
Others (pdf)	20
Total	**244**

C. Qualitative dialogues/ discussion threads

1. In this aspect teacher were posting some of their live session for example one teacher posted some teaching resources of Geometry as shown in the picture below.

2. Extension of the learning: The TE just provided a link for GeoGebra that can assist teacher in implementing the geometry module as shown in the screen shot below.
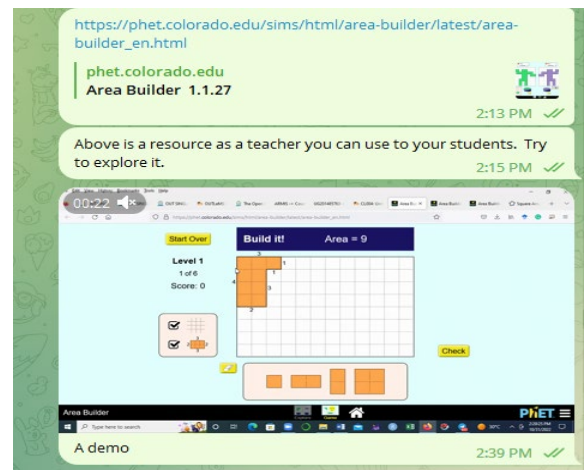
3. A TE also provided a warmup exercise in the Telegram group and teachers tried to respond as shown below.
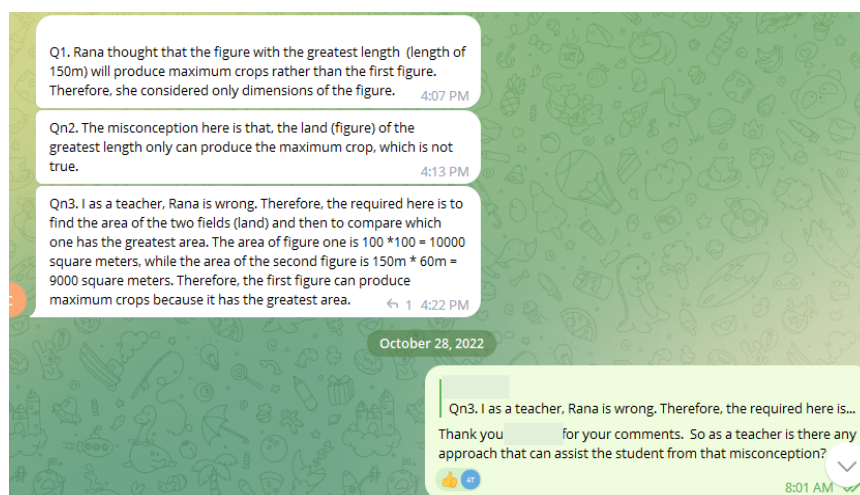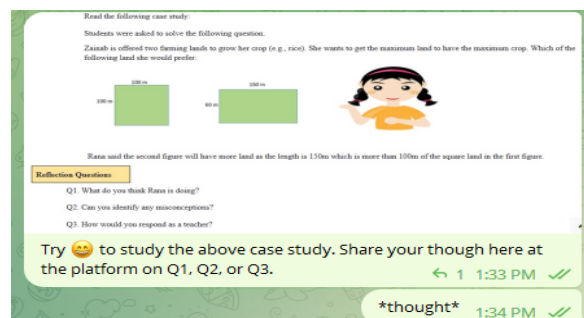
7. Teacher Educator's reflection on the overall implementation (Moodle and CoP)

A. Participation of teachers:

The TE posted some demo that can help teacher to teach geometry. This is evidenced by the adjacent picture.

Majority of NQTs were are cooperative in Moodle as well as in Telegram, as they were asking questions for clarifications. They also posted some pictures in live sessions when teaching. For example the below picture shows a teacher appointed a student to go on the board and demonstrate a certain activity in area of different objects.
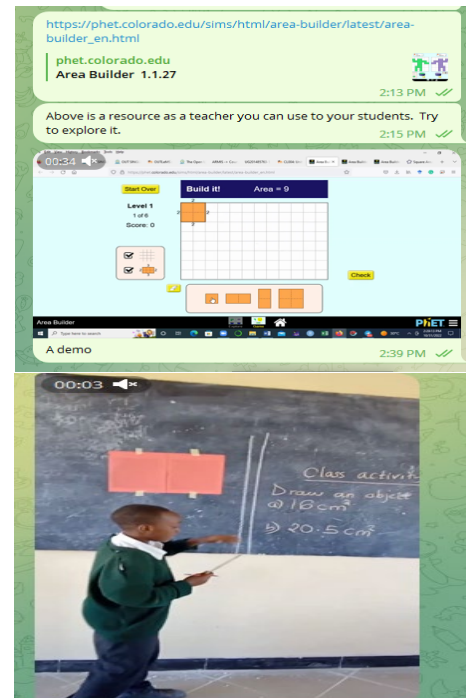
Below is the Moodle discussion forum part where TE asked teachers to watch a video and respond the reflection questions.

Reflection questions for section 1.3.1
Thursday, 24 March 2022, 9:39 AM

1. What are some misconceptions in the video?
2. Why do you think those are misconceptions?
3. What could be the cause of such misconceptions?
4. If you happened to observe these misconceptions in your class, how would you address them?

Pern

Re: Reflection questions for section 1.3.1
by   - Monday, 10 October 2022, 11:05 AM

Hello Teachers,
Any misconceptions in the video?
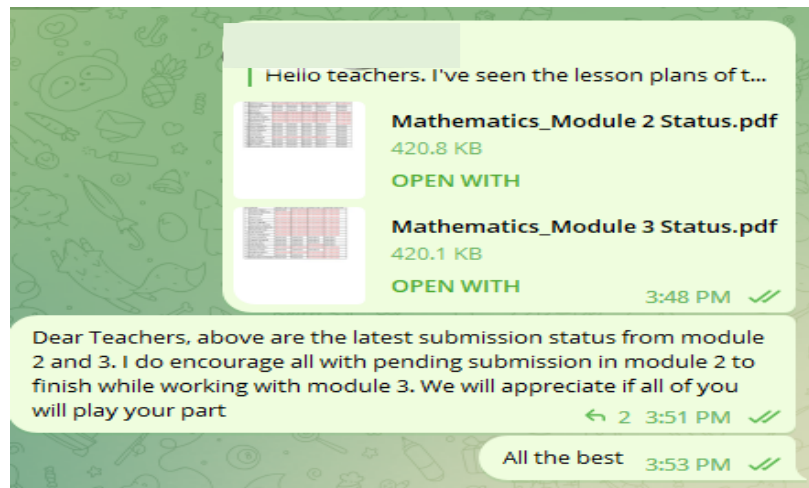
Permalink   Show parent   E

Re: Reflection questions for section 1.3.1
by   - Monday, 10 October 2022, 7:03 PM

1.Some studennt think that area and perimeter are the same

2.some student thought that if you cut a piece of a given shape,rather perimeter area decreases.

B. Challenges:

Some teachers are not cooperative despite of being called frequently. About 4 NQTs didn't do anything in the course to date. TE tried to encourage them but nothing changed in terms of participation in the project.

C. Surprises:

Teachers after attending a workshop and oriented on how to go through the module, four out of twenty teachers did not show any progress on the module. They all disappeared afterwards.

D. Any changes required in the module design:

May be to improve active participation of teachers in the module we may include even WhatsApp not only telegram as a means of reaching teachers.

Data sources used

1. Moodle completion rate raw data
2. Moodle time spent raw data
3. Teacher pre-test and post test data
4. Teachers' responses for the pre and post-test surveys
5. Lesson plans and reflections data

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