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Instructional Change After Participating In A Vedio Stimulated Recall In Teaching Fraction: A Case Study Of Hashimu

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ABSTRACT
This paper explores teacher's instructional change after participating in a Video Stimulated Recall (VSR) interview focused on supporting teaching development using Knowledge Quartet (KQ) Framework as a lens. Literature have observed that, topic specific in-service teacher professional development using VSR interview which was accepted as an effective professional development tool is limited in Nigeria. Evidence from the types of teacher professional development practiced. In this paper we reports Hashimu's (pseudonym) instructional change after participating in VSR interview in KQ dimensions in teaching fractions. Qualitative case study design was used. The units of analysis for episodes were the four KQ dimensions. The findings revealed that, Hashimu has experienced instructional change in lesson two after participating in VSR interview. This might be as a result of VSR interview which have helped Hashimu to note his areas of weakness in the critical incidents in lesson one and improved in the second lesson. The paper recommends among others that, the use of VSR interview and lesson observation should be in practice by primary school teachers to help them in developing their teaching knowledge of fractions.
Keywords: Teacher's instructional change, Video Stimulated Recall, professional development

INTRODUCTION

Teachers' Knowledge has been an important research focus for many decades. This resulted to practical interest in Nigeria on developing primary school Mathematics Teachers' Knowledge for teaching. This is evident from the growing number of professional development (workshops) for primary mathematics teachers frequently conducted by Non-Governmental Organization (NGOs). For example; United Nation Children's Education Fund (UNICEF), and United States Agency for International Development (USAID) with States Universal Basic Education Boards (SUBEB) across the country. From the perspective of providing the support to primary school teachers, it become quite clear that professional development which had previously been made available by a number of agencies had not adequately served these teachers' needs. In those professional development workshops, the focus was on developing teachers' knowledge, in particular, Content Knowledge (CK) which is their foundation knowledge and Pedagogical Content Knowledge (PCK) which is their teaching knowledge but not subject specific (mathematics) knowledge. Also, there were perceptions by the general public that, teachers in Nigerian primary schools are not competent in teaching (Aina, 2020). It is a justifiable perception as the results of examination conducted in states like Katsina, Jigawa, Zamfara, Kaduna, Bauchi and Borno just mention

but few show weak performance (De, Petterson, Morris, & Cameron, 2016; Aina, 2020; Abdulhamid, Yushau, & Sambo, 2020; Adewole, 2022*)*. This resulted to selecting Middle Basic Teacher that are teaching mathematics in the primary school.

In this paper, Knowledge Quartet (KQ) was selected because the framework identifies and develops teachers' mathematical knowledge in teaching. The Knowledge Quartet was developed by Rowland, Huckstep & Thwaites, (2005) as a framework for identifying and developing teachers' mathematical knowledge, and for lesson observation. Rowland and colleagues drew on videotapes from the mathematics classroom lessons where pre-service teachers utilized their mathematical and pedagogical knowledge in their teaching. The Knowledge Quartet (KQ) framework, not only focusing on identifying teachers' mathematical knowledge but also provides a way of developing such knowledge in teachers through reflective practices. This practice is the action of looking at what happened and why it happened. This allows teachers to learn and continually develop from their own experiences and to gain insight into how their Content Knowledge contributes to their teaching. Rowland *et al*, (2009) added that in order to assess teachers in their actual practice, there is a need for observing those teachers while they are teaching. This will give opportunities for teachers to view and review video recordings of their own teaching in order to reflect on practice. This approach was found to be effective in getting insight into teachers' thoughts and reflections on their own practice (Muir & Beswick, 2007) and has been used as an effective medium for promoting teacher professional development in mathematics classroom (Geiger, Muir & Lamb, 2015).

The choice of fraction as mathematical content focus in this study is due to the fact that fraction is an important aspect of mathematics curriculum (Ward & Thomas, 2006; Dogan-Coskum, 2019). Fractions are key content in primary school to address other mathematical contents like probability and algebraic reasoning. This was supported by Takker (2021) that, topic-specific knowledge is required for teaching mathematics. In addition, fractions helps the pupils to successfully learn topics like percentage, ratios, decimal numbers, proportion, multiplication, division, measurement and graphs. Despite all these importance of Fraction as related to mathematics, studies have shown that it is one of the topics teachers find it difficult to teach (Lamon, 2007). Teachers also find Fraction very difficult because integers and decimals can be calculated based on the decimal notation system, whereas fractions cannot be calculated in the same way as integers and decimals (Kusaka, 2021). In support of this, Mobova, Jita, and Chimbi (2022) observed that fractions are always difficult to teach from Grades 4 to 6 (equivalent to Middle Basic 4 to 6), especially improper fractions because it mix whole numbers and fractions. Mobova, *et al*,(2022) further observed that, another problem of the teacher at the primary school level is that, they are made to teach mathematics even when they failed the subject at school level. More so, while much attention is focused on studies of mathematics knowledge necessary for primary school teachers to teach mathematics, less attention has been paid to research on specific mathematics content domains such as Fraction (Mohammed, Nabie, & Clement, 2021). This is the reason why the study chose qualitative research method because it is used to explore several areas such as human behaviour which cannot be quantified but yet important for teachers in teaching.

METHODOLOGY

In order to study teachers' knowledge, taking the teaching process into consideration, qualitative research is appropriate (Creswell, 2013). Creswell further stated that, Case Study is used for in-depth exploration of individual cases, event or activity rather than group. This is because a Case Study research involves the study of a case within a real life, contemporary context or setting. The aim of a Case Study in qualitative research is to examine the phenomenon's uniqueness in relation to its totality (Everton, 2020).

To collect data, Videos of classroom lessons were used to provide opportunities for the teachers' self-reflection. Video Stimulated Recall (VSR) Interview involves the use of audio and video tapes to aid participants' recall of his/her thought processes at the time of that behaviour. With specific reflection oriented questions about critical incidents in the lesson, the VSR Interview was found to be a useful tool for supporting teachers in revealing unaware aspects of their teaching. This in turn, may potentially enable teachers to become more critical about their actions and decisions in the lesson. The interview was

conducted immediately after the first cycle of lesson observation. The purpose of VSR Interview was to gain insight into how the participants reflected on selected episodes I chose for interaction. Muir and Beswick (2007) were adapted to help in determining the participants' level of reflective awareness. Muir and Beswick, identifies three hierarchical levels of the reflective process are: technical, deliberate and critical.

The advantages of using VSR Interview were to provide a chance to get in-depth views of the participant and provide feedback on the quality of teaching. VSR Interview was also used as a Professional Development model that can help in determining the teachers' teaching gains (Weston, 2013). Video Stimulated Recall (VSR) Interview was chosen as the most appropriate technique to elicit Middle Basic Mathematics Teacher's thought about their Fraction Knowledge and Pedagogical Content Knowledge related to teaching actions. Video Stimulated Recall (VSR) interview approach is suitable for this study since the aim of using VSR interview was to explore possible association between any observed improvements (or lack of improvements) in teaching fractions across the Middle Basic Mathematics Teacher. Also, VSR Interview is a research procedure where video excerpts are played to participants, inviting them to recall a particular event and their thinking at that time (Lyle, 2003). Karen, Nanette and Jennifer (2023) argued that as a result of teachers watching and discussing clips selected to showcase particular mathematical content and representations, instructional decisions were focused on sense-making, and/or student explanations and reasoning. In this instance, the event played back to each participant were video excerpts of the Middle Basic Mathematics Teacher's own lesson which the paper had selected because these evidenced the Middle Basic Mathematics Teacher putting his Fraction Knowledge in to practice. Similarly, this technique allowed the paper to collect classroom data without disrupting the lesson.

Immediately after the VSR Interview, I conducted the second lesson observation with the participant. The aim was to determine what improvement, if any, in teaching development of the participant in teaching fraction are there over time in the context of interim VSR Interview. The participant were observed and videotaped in two lessons. The rationale for the choice of second lesson observation was to present an understanding and exploration of the real life situations regarding teachers' teaching after VSR Interview.

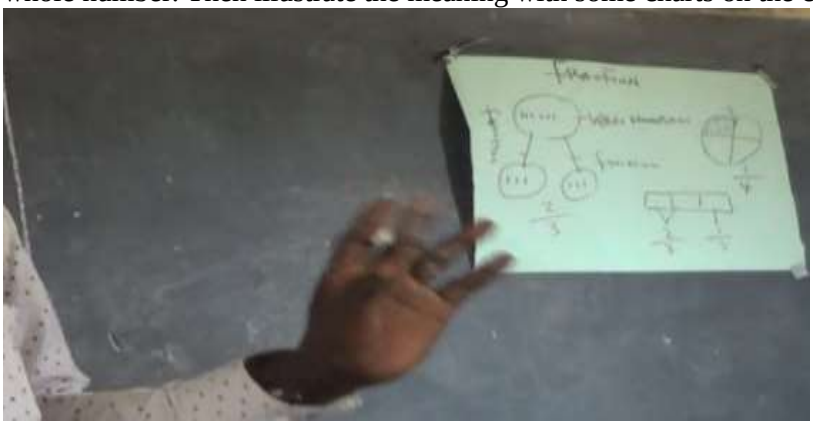
In this paper, Weston (2013) protocol for Maximum, Middle and Minimum was adapted to quantify the teacher's Choice and Use of Examples and Representations, which are in the Transformation dimension of KQ; Teaching Connections between or within lessons or topics, which is in the Connection dimension; and Teachers' Response to learners' unexpected or unplanned questions or ideas, which is in Contingency dimension. In the interview, Weston suggested that there is need to quantify the codes identified in a lesson to be able to determine the strength and weakness of a teacher in his/her lesson. Indicating the presence of KQ framework aspects alone does not adequately explain the relative quality and quantity with which Mathematical Knowledge in Teaching (MKiT) was demonstrated (Weston, 2013).

The case, Hashimu is a generic teacher who teaches mathematics at primary five in public primary school located in Gashua town of Bade Local Government area, Yobe State. Hashimu has 15 years of teaching experience at primary school level. He holds National Certificate in Education (NCE) qualification in Islamic Studies/Social Studies and first degree in Islamic Studies.

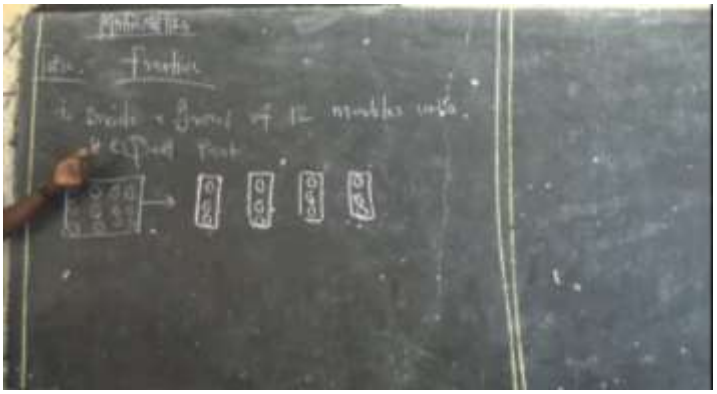
RESULT AND DISCUSSION

In Hashimu's first lesson with primary five, he started by discussing the previous knowledge of the learners on the meaning of fraction. He emphasised that fraction is representation of equal part of a whole number. Then Hashimu went ahead to show the learners different types of charts and ask them to identify and classify them. He then discusses the diagrams labeled with some fractions like $\frac{2}{5}$, $\frac{2}{3}$, $\frac{1}{3}$ and $\frac{1}{4}$. Hashimu then asked learners how $\frac{10}{5}$ was arrived at in the diagram but the learner could not offer any comment. To conclude the lesson, Hashimu gave the learners home work to write two examples of fraction.

The figure below was a video clip of how Hashimu is defining fraction as representation of equal part of a whole number. Then illustrate the meaning with some charts on the chalk board.



Example of a video clip of Hashimu's second lesson, discussing examples of fraction using some marbles as illustrated below.



He started by asking the learners to give examples of fraction. To introduce the topic fraction, Hashimu used 12 marbles divided into four equal parts to represent quarters and 12 marbles divided into three equal parts to represent thirds and gave the interpretation $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 4$ quarters and $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 3$ quarters. He went ahead to ask learners for 25 marbles divided into five equal parts and represent it same. A learner divided it and represents it as $\frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = 5$ quarters. Hashimu asked another learner again to divide 30 marbles into six equal parts and represent it in fraction. The learner divided it into six parts and each having two marbles, and represented it as $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = 6$ quarters. He now corrected the learner and concluded the lesson by giving them homework to go and show by diagrams how marbles was divided to represent different fractions.

From the count of incidents in Hashimu's first lesson in Choice and Use of Examples were; maximum was three, middle was zero and minimum was two. This implies that Hashimu's Choice and Use of Examples were in the maximum level where there were no error/mistakes with explicit focus on the concept.

While in Choice and Use of Representations, Hashimu's count was three in maximum, zero in middle and two in minimum level. This implies that Hashimu's Choice and Use of Representations were in the maximum level. This means there was no error/mistakes in Choice and Use of Representations in his teaching.

In Connection Between and Within lessons, topics or concepts, Hashimu's count were; three in maximum, two in middle and one in minimum. This implies that Hashimu's Connection Between and Within lessons, topics or concepts were in the maximum level where there was multiple connections in the teaching with explicit focus on the concepts.

Then in Response to Learners' unexpected or unplanned questions, answers or comments, Hashimu's counts were; maximum was three, middle was two and minimum was one. This implies that Hashimu's Response to Learner's unexpected or unplanned questions, answers or comments were in the maximum level where he responded appropriately to learners' questions, answers or comments, with press to interrogate learners' engagement.

In all the four codes, the total incidents in Hashimu's teaching were 12(55%) in maximum, 4(18%) in middle and 6(27%) in minimum. This implies that on average, Hashimu's teaching were in the maximum level where there was correct and in-depth explanations with explicit focusing on the concepts. There was also press to interrogate learners' engagement in the lesson.

Table One: Summary of Hashimu's Fraction Knowledge in Teaching for Lesson One

Lesson	Knowledge Quartet Codes	Minimum	Middle	Maximum	Total number of Episodes
1st lesson observation	Choice and Use of Examples (CUE).	2	0	3	5
	Choice and Use of Representations (CUR).	2	0	3	5
	Connections Between and Within lessons or topics (CBW).	1	2	3	6
	Response to Learners' Offers (RLO).	1	2	3	6
Total		6 (27%)	4 (18%)	12 (55%)	22 (100%)

The count of incidents in Hashimu's second lesson in Choice and Use of Examples were; maximum was nine, middle was zero and minimum was one. This implies that Hashimu's Choice and Use of Examples were in the maximum level where there was correct and in-depth Choice and Use of Examples with explicit focus on the concept.

While in Choice and Use of Representations, Hashimu's counts were three in maximum, four in middle and one in minimum. This implies that Hashimu Choice and Use of Representations were in the middle level where there was correct and in-depth Choice and Use of Representations with details explanations, but lacks conceptual connections.

In Connection Between and Within lessons, topics or concepts, Hashimu's count of incidents were; maximum was three, middle was six and minimum was zero. This implies that Hashimu's Connection Between and Within lessons were in the middle level where there was correct and no ambiguity in Connection Between and Within lessons, topics or concepts, but no press to interrogate learners' engagement.

While in Response to Learners' unexpected or unplanned questions, answers or comments, Hashimu's count were; maximum was three, middle was six and minimum was zero. This implies that Hashimu's Response to Learners' unexpected or unplanned questions, answers or comments were in the middle level where there was correct and no ambiguity in Response to learners' unexpected or unplanned questions, answers or comments, but no press to interrogate learners' engagement.

In all the four codes, the total incidents in Hashimu's teaching were 18(50%) in maximum, 16(44%) in middle and 2(6%) in minimum levels. Based on these results, Hashimu's teaching were in the maximum

level where there was correct and in-depth Choice and Use of Examples and Representations; making multiple connections between and within lessons; and responding appropriately to learners' unexpected or unplanned questions, answers or comments with explicit focus on the concepts. There was also press to interrogate learners' engagement in the lesson.

Table Two: Summary of Hashimu's Fraction Knowledge in Teaching for Lesson Two

Lesson	Knowledge Quartet Codes	Minimum	Middle	Maximum	Total number of Episodes
2nd lesson observation	Choice and Use of Examples (CUE).	1	0	9	10
	Choice and Use of Representations (CUR).	1	4	3	8
	Connections Between and Within lessons or topics (CBW).	0	6	3	9
	Response to Learners' Offers (RLO).	0	6	3	9
Total		2 (6%)	16 (44%)	18 (50%)	36 (100%)

In determining the teaching gains; in Choice and Use of Examples, the total incidents recorded in lesson one was five and that of lesson two was 10. This means there was teaching development recorded in lesson two since the total incidents is greater than that of lesson one. That is, the mode of Choice and Use of Examples Hashimu employed in lesson two was better than that of lesson one.

While in Choice and Use of Representations, the total incidents recorded in lesson one was five and that of lesson two was eight. This implies that there was teaching development recorded in lesson two since the total incidents were greater than that of lesson one. That is, the mode of Choice and Use of Representations Hashimu employed in lesson two was better than that of lesson one.

Similarly, in Connection Between and Within lessons, topics or concepts, Hashimu's total incidents recorded in lesson one was six and that of lesson two was nine . This implies that there was teaching development recorded in lesson two since the total incidents is greater than that of lesson one. That is, the mode of teaching connections enacted between and within lessons, topics or concepts Hashimu employed in lesson two was better than that of lesson one.

In Response to Learners' unexpected or unplanned questions, answers or comments; the total incidents Hashimu recorded in lesson one was six and that of lesson two was nine. This implies that there was teaching development recorded in lesson two since the total incidents of lesson two is greater than that of lesson one. That is, the mode of Response to Learners' unexpected or unplanned questions, answers or comments were better in lesson two than that of lesson one.

In summary, Hashimu recorded teaching development in all the Knowledge Quartet (KQ) codes used in this paper. This means Hashimu has experienced change in all the four KQ codes in lesson two, may be as a result of VSR interview that has helped him to watch his weak areas in lesson one and improve in lesson two.

Also, from the bar chart, Hashimu has experienced teaching improvements in all the four KQ codes; Connection Between and Within lessons or topics, Choice and Use of Examples and Choice and Use of Representations, and Response to Learners' Offers; since all the bars representing lesson two were longer than those of lesson one. This means the use of VSR interview as professional development model has helped Hashimu to be able identifies his weak areas in lesson one and improved in lesson two.

In addition, the VSR interview allowed the teacher to note his potential and limitations in how he responded to certain contingent incidents and envisage alternatives to how he could have responded which he might have previously considered. With specific reflection oriented questions about the critical

incidents in the lesson, the VSR interview was found to be a useful tool for supporting teachers in revealing unaware aspects of their teaching. The participant's self-reflection provides specific fraction teaching feedback. This in turn, may potentially enable him to become more critical about his actions and decisions in the class. By way of example, the VSR interview appeared instrumental in supporting Hashimu to bring statements of prerequisite skills explicitly to the fore in lesson two. His reflection as a result of the follow-up in the second lesson indicated ongoing learning and his long prior teaching experience. However, the potential for improved enactment of his knowledge and skills was seen in his Choice and Use of Examples, Choice and Use of Representations, Connection Between and Within lessons or concepts and Response to Learners' Offers.

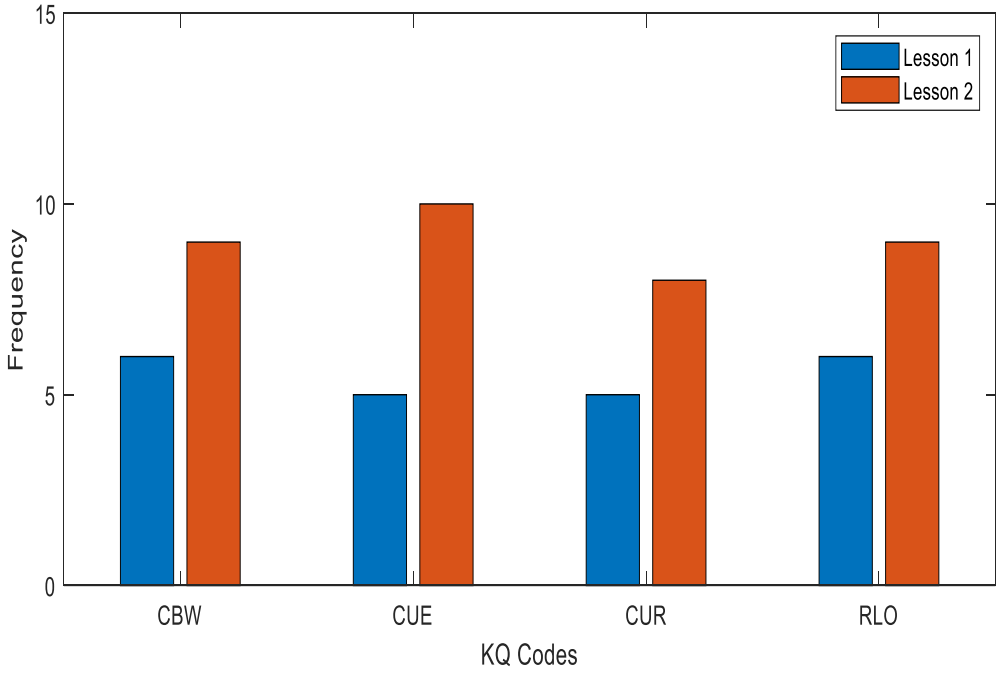


Figure One: Bar chart showing Hashimu's Teaching Development.

CONCLUSION

In summary, Teacher professional development in Nigeria were organized through seminars, conferences, or provided by Nigerian teacher training institutions or donor-funded projects or through workshops. Lack of content specific pedagogical approaches for teaching fraction, many rich opportunities for reasoning and sense-making in the field of mathematics are lost, for instance, algebra and probability which are related to fraction.

As a result, there is urgent need to address this problem using Knowledge Quartet framework as a lens because the framework identify and develops teachers' Content Knowledge and Pedagogical Content Knowledge to be responsive in their classrooms. The teachers need an integrated knowledge of content, pedagogy and curriculum materials.

Considering the result of Hashimu, Video Stimulated Recall (VSR) interview which was accepted globally as a useful tool for teacher professional development has help him to reflect on his thoughts and decision making in response to contingent events which emerged across his lessons. Weston (2013) observed that when VSR interview protocol was used as professional development model, that can help in determining the teachers strength and weakness in teaching.

The study suggested for teacher professional development that is aligned to teachers' Fraction Knowledge (FK) which can help them improve their classroom practice. When a teacher cannot evaluate the success or otherwise of his/her lesson is a problem in teaching and learning fraction.

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