Teachers' Support on the Effective Implementation of the Five Key Formative Assessment Strategies in Mathematics Instruction in Secondary Schools: A case of Nandi County, Kenya.

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ABSTRACT

Teachers' support is key in effective implementation of formative assessment strategies towards improvement of learners' achievement in Mathematics instruction. However, there is lack of attention it has previously received hence the need for teacher support on effective implementation of the Five key Formative Assessment Strategies(FAS) in Mathematics instruction including: Clarifying and sharing learning intentions and criteria for success, Engineering effective classroom discussions, questions and learning tasks, Feedback that moves learners forward, Self-assessment and Peer assessment towards improved learning. The purpose of this study was to investigate Teachers' support on effective implementation of the five key Formative Assessment Strategies in Mathematics instruction in secondary schools. The study was carried out in secondary schools in Nandi County, Kenya. Proportionate, stratified and simple random sampling were used to select 12 schools, 33 mathematics teachers and 12 head teachers. Quasi-experimental mixed method intervention design was employed. Data was collected using teachers' questionnaires, head-teachers interviews and teachers' focus group interviews. Data was analyzed by use of descriptive and thematic analyses. Findings revealed that there was inadequate teachers support, there was lack of training offered to teachers on FAS, lack of adequate resources and materials, big class sizes which did not favor the good use of FAS, lack of time to plan for FAS, FAS was not included in the curriculum, there was inadequate head teacher support and lack of understanding of learners' context by the teachers. The study recommends that Teacher support is needed in terms of time, curriculum modifications, resources/materials, class sizes and periods. Intensive training of head teachers and all stakeholders should also be done on the support needed for successful implementation of FAS. Curriculum reviewers must involve stakeholders (Mathematics teachers) so that the reviewed curriculum supports effective implementation of FAS in terms of class sizes, time, learning materials and class periods.

1.0 Introduction

According to Global Monitoring Report (2016), the Sub Saharan Africa investment in education has not fully translated to development of functional skills and knowledge that could transform economies of which they live in general and individuals in particular. The report of Africa Progress Panel (2012) established that African children transiting to secondary schools from primary school lack basic literacy and numeracy skills, implying that children experiences deficits in basic learning competencies. Education reforms are done in many countries Kenya included that are driven by new economic imperatives and that generally calls for realignment of assessment concepts to match the prevailing educational goals (Berry and Adamson, 2011)

Research evidence indicates that formative assessment is one of the most effective ways of enhancing student learning. However, it is difficult to implement successfully, principally because what is tested through summative assessment has such a powerful influence on teacher and student actions (Carless, 2012). Formative assessment is a process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve students' achievement of intended instructional outcomes (Riley-Ayers, 2014). Formative assessment is a learner centered approach which is bound up with students becoming autonomous lifelong learners who are active participants in the classroom and beyond (Cowie, 2013) and according to OECD (2012) lifelong skills development will effectively address inequality, access to quality education, acquisition of essential skills for social development, labour market integration and youth unemployment challenge. Five key formative assessment strategies identified in research as very effective in improving learners' achievement include: Clarifying and sharing learning intentions and criteria for success, engineering effective classroom discussions, questions and learning tasks, Feedback that moves learners forward, Self-assessment and Peer assessment (Michael & Dell Foundation, 2016), were the focus of this study.

According to Riley-Ayers (2014), implementation of a formative assessment process is not a one- time event, but rather it is a decision that needs systemic change and requires professional development to train, empower, and support

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teachers and educational leaders charged with its implementation. However, teachers' understanding and expertise with assessment is crucial, but has been found to often been lacking and there is evidence that teachers are better at drawing reasonable inferences about student levels of understanding from assessment information than they are deciding the next instructional steps to take.

According to Perry (2013), in the study formative assessment use and training in Africa, It was revealed that supporting teachers in understanding how to use formative assessment data is integral to its benefits (Ottevanger et.al, 2007) and additional teacher training was being advocated for in this area due to lack of attention it has previously received and because insufficient teacher training is frequently identified as a barrier to implementation and change (Broun & Kanjee, 2006).

Michael & Dell Foundations (2016), in the study "Formative Assessment in the classroom: findings from three districts", the Survey data and teacher observations show that while many teachers do use some form of formative assessment in their classrooms, they have a limited repertoire and they do not necessarily use these strategies daily. Because formative assessment is a fundamental part of instructional practice, asking teachers to change their practice to accommodate more or improved formative assessment requires support for capacity building including time for reflection, in-school modeling and coaching, access to materials and ongoing, targeted feedback. While districts have set up structures that could support such capacity building, such as support for professional learning communities (PLCs), provision of coaching and trainings for school administrators among other things, these supports are not necessarily targeted at formative assessment per se. Riley-Ayers (2014) posits that reliable assessment and effective data use require considerable training and support for educators and administrators Hence the purpose of the current study was to investigate the teachers' support on the effective implementation of the five key formative assessment strategies in Mathematics instruction in secondary schools in Nandi County, Kenya.

2.0 Literature review

A study by William (2006) reported on the place of formative assessment and instruction whereby teachers who were given support to implement formative assessment techniques in their classrooms were able to rapidly close student achievement gaps by 50 percent (Kiplagat,2016).

Melani (2017) in a mixed-methods study whose purpose was to gain insights and understandings of high school teachers' perceptions and use of formative assessment to enhance their planning, individualization of instruction, and adjustment of course content to improve student learning. The study was conducted over two years in a mid-western high school of approximately 1,000 students. Crucial to the three project teachers' understanding of formative assessment was developing and using preset curriculum road maps that tightly aligned course goals, learning objectives, activities, instructional methods, and assessment. The in-depth case studies of the sample's three teachers revealed that, when provided with specific information about formative assessment through staff development, they became more positive toward such assessment, and their implementation skills were greatly improved. The staff development had an especially positive impact on the teachers' understanding and skill sets for individualizing instructional practices. The

personalization of the staff development proved to be the most beneficial when it tailored the content to the varying levels of initial proficiency of the three sample teachers. Support for formative assessment by the administrative team members was essential to creating a cultural shift from summative to formative assessment.

Melissa (2015) posits that formative assessment has been demonstrated to result in increased student achievement across a variety of educational contexts. When using formative assessment strategies, teachers engage students in instructional tasks that allow the teacher to uncover levels of student understanding so that the teacher may change instruction accordingly. Tools that support the implementation of formative assessment strategies are therefore likely to enhance student achievement. Connected classroom technologies (CCTs) include a family of devices that show promise in facilitating formative assessment. By promoting the use of interactive student tasks and providing both teachers and students with rapid and accurate data on student learning, CCT can provide teachers with necessary evidence for making instructional decisions about subsequent lessons. In this study, the experiences of four middle and high school science teachers in their first year of implementing the TI-Navigator system, a specific type of CCT, are used to characterize the ways in which CCT supports the goals of effective formative assessment. CCT was found to support implementation of a variety of instructional tasks that generate evidence of student learning for the teacher. The rapid aggregation and display of student learning evidence provided teachers with robust data on which to base subsequent instructional decisions.

One method for monitoring student learning is formative assessment. As part of a project funded by a state department of education grant, Mathematics teachers received professional development (PD) in the principles of formative assessment to enhance the learning of all students in their classroom, including those with exceptional learning needs. This study inform the present study that formative assessment methods spotlighted in the project, along with how formative assessment was implemented in two algebra classrooms. Through the formative assessment project, teachers received PD on formative assessment provided by university faculty with expertise in Mathematics education and instructional methods for students with exceptional learning needs. The teachers were supported in implementing formative assessment methods by coaches who observed instruction and provided feedback and suggestions. Specifically, the teachers formed professional learning communities and agreed on the use of specific questions to guide implementation of formative assessment repeatedly in their mathematic classrooms.

Throughout the project, teachers received PD on formative assessment methods, including breaking problems into steps for error analysis; using data collection charts to identify student response patterns; providing multiple probes to assess student understanding; and embedding one key question into a formative assessment for analysis. There was evidence that teachers after receiving support from the school and the government were able to implement the formative assessment strategies and improvement in students' performance (Accardo, 2017).

Box's (2015) research revealed distinct differences among the three teachers and several different factors that constrained or facilitated the use of formative assessment in

their instruction. Most notable of these factors were the forms of teacher knowledge that played a critical role in shaping their assessment practices and had a bearing on their ability to convert espoused theories about assessment into actual classroom practice. Other externally imposed barriers that constrained the use of formative assessment included expectations, habits, and dispositions of students; the pressure that teachers felt to "cover" all of the curriculum in order to prepare students for the end-of-year, high-stakes exam; and an instructivist rather than constructivist approach to teaching and learning. Results from this study add to the growing body of knowledge about the complex terrain teachers negotiate in making teaching and assessment decisions and provides a framework for future studies.

2.1 Theoretical framework of the study

The study was based on the formative assessment framework of Dylan and Thompson (2007) guided by socio constructivist theory of Vygotsky (1978) and Heritage (2010) model of formative assessment.

3.0 Methodology

The study was conducted in Sub-County Public secondary schools in Nandi County, Kenya. The Proportionate, Stratified and simple random sampling were used to select 12 schools, 33 Mathematics Teachers and12 head-teachers. The Paradigm of the study was Pragmatism and the study employed Quasi-experimental mixed method intervention research design. This study adopted an explanatory sequential mixed methodology where both quantitative and qualitative data were collected using teachers' questionnaires and interviews. Quantitative data was collected and analyzed using frequencies and percentages followed by qualitative data collected through interviews and analyzed thematically. The qualitative data was used to explore in depth the quantitative findings of this research. Teachers' support on the effective implementation of the five key formative assessment strategies in the William and Thompson framework (2007) were investigated and the results are presented in the next sections.

4.0 Results and Discussions

4.1 Quantitative Data on Teachers' Support for effective Implementation of the Five Key Formative Assessment strategies.

Teachers were asked whether they have enough time to plan for formative assessments, and as indicated in table 37, a majority 72% of the teachers disagreed as compared to 28%

of the teachers who agreed. On whether the teachers have head teachers' support on the implementation of FAS, a majority 85% disagreed as 15% agreed. On whether the school provide adequate materials to support formative, a majority 88% disagreed as 12% agreed. On whether the school provide them with adequate training on formative assessment practices, a majority 84% disagreed as 16% agreed. On whether the curriculum has included very well the use of formative assessment strategies, a majority 75% disagreed as 25% agreed.

On whether the school facilitates the use of technology e.g. computers, internet, and projectors in the implementation of the formative assessment strategies, a majority 73% of the teachers disagreed as some 27% agreed. On whether the class sizes allow teachers to practice formative assessment strategies comfortably during Mathematics lessons, a majority 82% disagree while 18% agreed and on whether the class periods allow teachers to practice formative assessment strategies successfully, a majority 70% disagreed as 30% agreed. Thus the findings are indicative of an assertion by a majority of the teachers who participated in the study that the class periods provide enough time to use formative assessment strategies. However as indicated in the findings, in most of the schools that participated in the study, the teachers are not provided with adequate training on formative assessment practices. A majority 70% of the teachers disagreed on this statement as only 30% acknowledged.

When teachers were asked whether there is need for reducing class sizes to allow for individualized instruction, a majority 75% agreed as only 25% disagreed. On the need for enough time during class periods to use formative assessment, a majority 70% of the teachers agreed as compared to only 30% who disagreed.The results show that a majority of the teachers disagreed that they were given support in terms of time, curriculum modification, head teachers support materially and professionally, provision of necessary materials/tools, adequate training and facilitation for use of new technology in implementation of the five effective formative assessment strategies in Mathematics instruction. In addition the class sizes and class periods do not support the effective implementation of FAS in their mathematics classrooms.

Table 1.Support for Implementation of the Five Effective Formative Assessment strategies.

	Strongly Agree		Agree		Disagree		Strongly Disagree	
	F	%	F	%	F	%	F	%
1) I have enough time in school to plan for formative assessment.	2	(7%)	7	(21%)	10	(30%)	14	(42%)
2) I have head teacher support in incorporating formative assessment strategies into my teaching practice.	1	(3%)	4	(12%)	17	(52%)	11	(33%)
3) My school provides me with adequate materials/tools to support formative assessment.	1	(3%)	3	(9%)	14	(42%)	15	(46%)
4) My school provides me with adequate training on formative assessment practices.	0	(0%)	5	(16%)	14	(42%)	14	(42%)
5)The curriculum has included very well the use of formative assessment strategies	3	(9%)	5	(16%)	11	(33%)	14	(42%)
6) My school facilitates the use of technology in the implementation of the formative assessment strategies, e.g. computers, internet, and projectors e.tc.	1	(3%)	8	(24%)	11	(33%)	13	(40%)
7) The class sizes allow me to practice formative assessment strategies comfortably during mathematics lessons.	3	(9%)	3	(9%)	10	(30%)	17	(52%)
8)The class periods allow me to practice formative assessment strategies successfully	1	(3%)	9	(27%)	11	(33%)	12	(37%)

Based on the finding on support, the implication is clear that there was inadequate support on the implementation of the formative assessment strategies (Majority 88% disagreed that there was support) and this finding is in line with the finding of Kemboi (2015) in his study on classroom assessment practices by mathematics teachers in secondary schools in Kenya, who found that teachers had little or no neither experience or training on the use of the types of classroom assessment practices used. Also this finding corroborates with Michael & Dell Foundations (2016) whose findings revealed that teachers across all the three districts report that the support provided by districts for formative assessment is insufficient and that they most often turn to their colleagues for support to improve their formative assessment strategies.

There was need to collect qualitative data in order to have an in-depth understanding of the factors behind inadequate support and teachers' interviews were conducted. Data from Teachers interviews on support was analyzed and presented in form of descriptions and excerpts discussed in the next sections.

4.2: Qualitative data on teachers' support for implementation of the formative assessment strategies

Based on the quantitative finding on teachers' support for the implementation of the five FAS, an exploration using face to face interviews and focus group interviews were carried out on teachers and head teachers to seek in-depth understanding on the teachers 'support for effective implementation of formative assessment and the data were analyzed thematically with the following themes ; Training, resources and materials, class sizes, time, curriculum inclusion, head teacher support, class periods and number of trained Mathematics teachers, technology integration and the understanding of learning contexts. These themes were discussed in the next sections.

4.2.1: Training

Concerning the training**,** teachers were asked whether they have received any kind of training specifically for formative assessment and all of them mention that they have never received any training of that kind in their life and therefore there was lack of teacher preparedness to use formative assessment strategies. A sample of what they said is as follows:

"I have never gone for seminar or for workshop specifically for formative assessment" **(teacher 8)**

"I have not experienced even in the County, we only have seminars for emerging issues on the subject, particular topics where students perform poorly in KCSE" **(Teacher 6)**

"There is no training specifically for formative assessment**" (teacher 3)**

The teachers also went further during the interview to give their recommendations on the status of the training and they had the following to say:

"There is need for training of teachers so we should have those workshops or seminars" **(teacher 9)**

"If you can share the idea to the examiners so that when they are having these seminars they also include this because it is important" **(Teacher 7)**

"Education stakeholders should come up with ways of training teachers on this kind of formative assessment" **(Teacher 12)**

4.2.2: Resources and materials

On the availability of the resources and materials majority of the teachers were of the opinion that they lacked adequate resources and materials to support formative assessment practices in their mathematics lessons. And as one of the head teacher asserted that:

"Yes the Government support us averagely with resources but not equitably in the schools around, we do not have equal distribution of resources and so low achieving schools are not considered most of the times therefore the performance will continue being poor and even to implement these good strategies of formative assessment may be challenging for us'' **(Principal 4)**

4.2.3: Class sizes

The number of students in most of the classes was above the required 45 students per class.

Formative assessment strategies are good but we have a big challenge with the class size resulting from Free Education in Kenya. So implementing these strategies will be difficult for us **(Teacher, 1)**

4.2.4: Few Mathematics teachers

The number of teachers teaching Mathematics in secondary schools is not proportional to the class sizes hence difficult to implement formative assessment strategies.

"More teachers to be employed, if we had just enough lessons you will be having enough time to develop or create learner activities so that the lesson becomes learner centered otherwise if you are busy from one class to another you will not have enough time in that case you will start lecture**" (Teacher 3)**

4.2.5: Technology integration in Mathematics instruction

There was lack of technology integration in the teaching and learning of Mathematics in secondary schools. Technology integration will facilitate effective implementation of formative assessment strategies during instruction. Devices like the navigator can be introduced during Mathematics lessons to help teachers in collecting data from the learners' responses within the shortest time and be able to give immediate feedback. There was no single school in the sample that integrated lessons with technology. The findings of this study revealed that none of the technologies were used during lessons there is need to integrate lessons with technology in order to have effective implementation of the five key formative assessment strategies in Mathematics instruction in secondary schools in Nandi County, Kenya. The respondents had the following to say:

"In our school, we do not teach using any technological instruments, if there are those devices to help us get students responses very fast then we need to have them in place so that we can give them feedback immediately during lessons to improve the teaching and learning of Mathematics". **Teacher 4**

4.2.6: Time

Time is a factor which was identified by the teachers as a big challenge in the implementation of formative assessment and they had the following to say

"The big challenge which have become very striking is time to attend to all those groups due to big number of students**" (Teacher 4)**

"The caliber of students we have really require time, our learners are slow in learning, so if we get extra time, it is important**" (Teacher 10)**

"Sometimes it can be slow in designing the activities you see, those activities to be used well in class sometimes

takes a lot of time so comparing these strategies with covering syllabus sometimes they collide**" (Teacher 6)**

"Designing activities for lesson takes time, we are having so many lessons so we do not have enough time" **(Teacher 7)**

4.2.7: Curriculum inclusion

On curriculum issues, the teachers indicated that the current curriculum in Kenya is not working for the effective utilization of formative assessment strategies because assessment used focuses mostly on examination oriented summative assessment hence very difficult to implement formative assessment fully. The teachers had the following to say:

"Formative assessment strategies have not been included in the curriculum so much" **(Teacher 3)**

"I do not think they have included so much may be because it is normally CATS we normally do then final exam, I think it is kind of summative that is in place" (**Teacher 9**)

"I think the curriculum should be designed in a way that students should be assessed formatively, in my opinion formative assessment should be included in the curriculum" **(Teacher 11)**

4.2.8: Head teacher support

According to the teachers, support from the head teachers was not adequate and this may have contributed to low utilization of the five effective formative assessment strategies. In their own words they had the following to say:

"Head teacher support is minimal on formative assessment strategies, the only support we get is during processing of continuous assessment tests but during teaching and learning may be the support on text books used in class**" (Teacher 5)**

### 4.2.9: Understanding learning contexts of the learners

Teachers indicated lack of thorough understanding of the learners' learning contexts which include: Entry behavior of learners, social backgrounds of the learners, school culture and societal-cultures which are found to be very crucial for effective implementation of the five formative assessment strategies therefore teachers need to learn and understand the contexts of their learners first before implementing FAS. Teachers had the following to say:

"Implementing such good formative strategies may be difficult due to the type of students we have in our school and the socio-cultural beliefs of the surrounding communities where our students come from. There is need to understand these cultures for easy implementation of these formative strategies" **Principal 2**

This study saw the need of adding the fourth question on top of the three questions in the framework of William and Thompson (2007) that will address learning contexts in order to successfully and completely identify and close the learning gaps of learners so as to optimize learners' learning. According to the formative assessment framework by Dylan and Thompson (2007), teachers and students answer three questions when using assessments formatively: Where the learner is going? Where the learner is now? and How to get there?. From the research finding that context affects the level of use of formative assessment strategies, this study added the fourth question: WHERE THE LEARNER IS COMING FROM? (WHO IS THE LEARNER?), to the formative assessment framework of Dylan and Thompson (2007) which

should be the first question in the framework of formative assessment.

This question concerns the need for teachers to know their learners properly which involves knowing their socio cultural contexts, their level of understanding, their school culture contexts in terms of resources available, and their learning needs and difficulties. This will aid in the right identification of the learning gaps and therefore the four questions will make the process of identifying and closing of the learning gaps complete and on this basis a modified model of the four questions of the formative assessment framework was developed by the researcher.
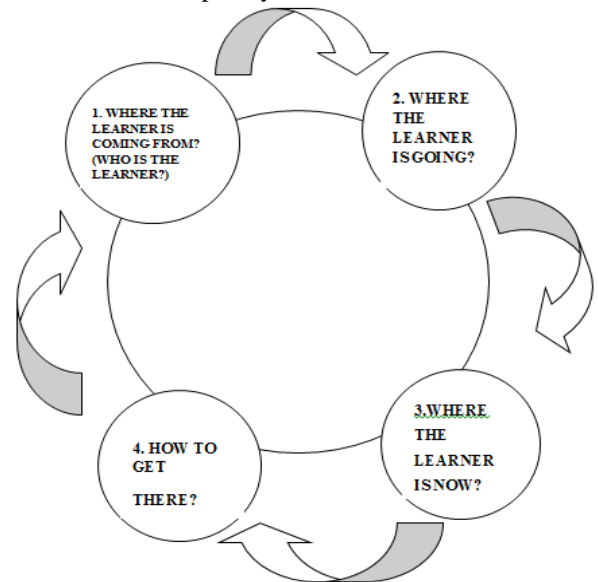
Figure: Modified Model of Formative Assessment
(Source: Researcher)

Question 1 in the above model is the added question by the researcher and question 2, 3 & 4 are the original questions in the Dylan and Thompson (2007) framework of formative assessment.

5.0 Conclusion

Based on the findings, there is need for adequate teacher support in order to have effective and successful implementation of the five FAS in Mathematics instruction in secondary schools in Nandi County, Kenya. The support needed is in terms of time, curriculum modifications, resources/materials, class sizes and periods, technology integration, regular teacher trainings and incentives, learner training on the skills of conducting formative assessment, head teacher support (administrative), understanding learner contexts and embracing professional learning developments towards effective implementation of the formative assessment strategies to improve learner achievement and acquisition of problem solving skills in order to have life-long learners.

6.0 Recommendations

The following recommendations were made based on the findings of the study findings

1. Teacher support is needed in terms of time, curriculum modifications, resources/materials, class sizes and periods, technology use, regular trainings and incentives.

2. Intensive training of head teachers and all stakeholders should be done on the systemic support needed for successful implementation of FAS.

3. Curriculum reviewers must involve stakeholders (Mathematics teachers) so that the reviewed curriculum

4. supports effective implementation of FAS in terms of class sizes, time, learning materials and class periods.

5. Professional developments should be encouraged to strengthen teachers towards effective implementation of FAS.

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