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## Utilization of Instructional Materials for Personalized Learning of Mathematics in Public Primary Schools: A Case of Eldoret East Sub County, Kenya

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### **Abstract:**

*Most people agree that a major goal of schooling should be the development of students' understanding of basic mathematical concepts and procedures. Unfortunately, there is considerable evidence to indicate that this objective is not being met (UNESCO, 2015). Accordingly, the purpose of this study was to investigate the utilization of Instructional Materials for personalized learning of Mathematics by teachers in public primary schools in Eldoret East Sub County. This study employed descriptive survey design. The study target population was 3147 drawn from 151 Primary schools in Eldoret East Sub County. Data was collected using questionnaires, document analysis and interviews and analyzed using descriptive statistics and qualitative thematic approach. The findings of the study revealed that most of the schools had varied materials to suit learners' differences though, majority of teachers did not choose materials depending on learners individual needs, in addition the study found out that though skills acquired by teachers' were critical in improving personalized learning many teachers were lacking the skills. The study recommends that with the increased and easy access to technology, government in partnership with individual schools should develop Mathematics instruction software that suits personalized teaching and learning that are child and teacher friendly. This study is helpful in that it helps teachers to identify ways of introducing learners to personalized study through Information and Communication Technology (ICT).*

**Keywords:** Instructional materials, Personalized learning, Mathematics

### **1. Introduction**

Early interventions, for learners having difficulties learning Mathematics in school are a primary responsibility of education professionals. Although as Sutherland (2007) states teaching do not seem to pay attention to this learning activity. It is therefore imperative to create a personalized learning culture designed to suit the instruction materials (Keefe, 2007). Boudett, City & Murnane (2006) indicated that personalized learning involves a continuous intentional adjustment of instructional strategies, determined by the evidence gathered through thoughtful formative assessment process. In the article, "*Personalized Instruction in United States*" Keefe and Jenkins (2002) reviews on basic elements of personalized instruction that entails a school accounting for individual student characteristics and needs, using flexible instructional methods to organize the learning environment.

Meaningful learning of Mathematics in Kenya has been problematic owing to absence of teaching and learning materials as noted by (Kilundo, 2002). This has been further exacerbated by a high student population and unsustainable utilization of resources (Kanaga, 2010). Instructional materials are key to meeting these challenges through imparting knowledge to students in the educational process (Dahar & Faize, 2011). It is against this backdrop that one of the strategies outlined in Kenya Education Sector Support Programme (KESSP) was to address issues related to textbooks in improving learning outcomes. To overcome this problem and create interest and motivation on the part of the students, Killion (2012) asserts that Mathematics teachers should constantly consider the use of effectively readily available instructional materials on a personalized level in the teaching of Mathematics.

Literature indicates that the use of instructional materials in teaching Mathematics has a long tradition and research history. Instructional materials not only allow students to construct their own cognitive models for abstract mathematical ideas and processes, but they also provide a common language with which to communicate these models to the teacher and the teachers (Sutton & Krueger, 2002). Ruzic and O'Connell (2001) found that long-term use of instructional materials has a positive effect on learners' achievement by allowing the learners students to use concrete objects to observe, model and internalize abstract concepts.

Jotia and Matlale (2011) define a mathematical tool as, any object, picture, or drawing that represents a concept or onto which the relationship for that concept can be imposed. This implies that instructional materials are physical objects that students and teachers may use to illustrate and discover mathematical concepts. Such materials may include but not limited to items such as textbooks, magazines, newspapers, pictures, recordings, slides, videos, video disc, workbooks and electronic media such as radio, CD-ROMS and online services (Dahar & Faize, 2011). However, Dahar and Faize (2011) noted that most of the developing countries including Kenya face problems of using instructional materials in teaching and learning. Dahar & Faize (2011) suggest that, only the lower quality instructional materials are provided to schools and teachers are not well trained properly in using some instructional materials.

It is explicit to point that constructivist instructional theory advocates for instructional designers to determine which instructional methods and strategies will help learners to actively explore topics and advance their thinking. Learners are encouraged to develop their own understanding of knowledge. This does not show the role of practice and feedback, but rather allows learners more liberty in developing knowledge structures. Both the cognitive and constructivist theories share some commonalities, including having learners actively involved in learning and structuring solutions so that learners can extract the maximum amount of data (Schunk, 1996).

Richardson (2012) explained that personalizing learning means allowing students to choose their own paths through a curriculum. Personalized learning environments are powered by a student-centered classroom in which students have choice in what they learn, how they learn, and when they learn. When students have direct access to a laptop computer, the learning switch is always on and there is a chance to constantly keep learning in motion. The domain of utilization involves the use of processes and resources for learning. It deals with the planning and overseeing of the implementation and/or the delivery of instruction. Seel & Richey (1994) asserts that the domain of utilization consists of four sub-domains: Media utilization, diffusion of innovation, implementation and institutionalization, and policies and regulations. They define media utilization as the systematic use of resources for learning. The sub-domain involves checking the site for the availability of equipment needed to use the learning products and for ensuring the equipment is working properly.

The teacher skill is one of the important inputs into the educational system. Being the locus of classroom instructional activity and curriculum delivery, they are critical determinants of the quality of education. Sabeen & Bavaria (2005) have synthesized a list of the most significant principles related to Mathematics teaching and learning. This list includes the expectations that teachers know what students need to learn based on what they know. In support of usage of curriculum materials and experience, literature demonstrates that teaching experience and an extensive understanding of pedagogy may improve one's ability to plan lessons that use a variety of materials and better meet the needs of one's students (Anhalt, 2006; Behm & Lloyd, 2009).

Leslie, Booren, Downer, and Vitiello (2012) observed that the type of resources used by teachers and the way teachers interact with students influences their learning. To promote order and learning in the classroom every teacher should possess essential teaching skills. Criu (2014) confirms that improving students' outcomes in class is about improving the quality of the teaching pedagogy, as opposed to the traditional subject matter knowledge. Criu, argues that, though closely related pedagogical knowledge is not exactly the same thing as knowledge of subject matter; the two are nevertheless, intimately linked, because the teachers' mastery and its use in the classroom will indicate the depth of their knowledge of subject matter (Luvisia, 2003). In relation to the use of instructional materials it has been noted that teachers had negative attitude towards the use of learning resources.

Zeichner (1992) has summarized the extensive literature that describes successful teaching approaches for diverse populations. Several assertions about appropriate strategies for delivering Mathematics instruction were made. They include the fact that: Instruction focuses on students' creation of meaning about content in an interactive and collaborative learning environment. Teachers avoid repetitive rote learning but instead, involve learners in novel problem-solving activities. Watende (2017) states that teachers expose learners to challenging activities. They ask open-ended questions requiring students to use their judgment and form opinions. They choose activities where students must use analytic skills evaluate and make connections. They expect students to conduct research, complete their homework, and manage their time effectively.

### *1.2. Statement of the Problem*

The Kenya Vision 2030 aims at creating adaptive human base to meet the requirement of a rapidly industrializing economy. Poor town planning, lack of skilled manpower to construct roads and sewerage system in the county, scarcity of qualified surveyors (Uasin Gishu County, 2016), are some of the problems that need to be addressed by producing quality mathematicians in the county, if the Kenya Vision 2030 is to be achieved.

Despite the importance attached to Mathematics, the performance of the subject in Eldoret East Sub County has been average and as a result the county cannot produce competitive workers to match the global market demand (Uasin Gishu Education Office, 2012). According to the Ministry of Education, Science and Technology (2016), the mean score of Mathematics in Eldoret East in K.C.P.E in 2012 - 2015 was 54.56, 54.32, 54.78 and 54.79. This is an indication that quite a number of students were operating below average. Eldoret East Sub County Director of Education (S.C.D.E.) associated the low grades in Mathematics to: less contact hours, ineffective use of teaching and learning materials and unethical work and practices adopted by teachers.

The Kenya Ministry of Education (MOE, 2010) evaluation by World Bank on free primary education reported that the use of textbooks and other instructional media resources improved pupils' performance and increased pupil retention in school. Nevertheless, as Okobia (2011) observed that while some educators are fascinated by the potential of instructional materials in enhancing teaching and learning, other teachers lagged behind in using them to teach in some developing countries such as Nigeria and Kenya.

### *1.3. Research Objectives*

- i. To establish the utilization of instructional materials for personalized learning in Mathematics in Eldoret East Sub County.

- ii. To assess the teachers' skills in utilizing instructional materials on personalized learning of Mathematics in Eldoret East Sub County

## 2. Research Design and Methodology

The current study was guided by the descriptive survey research. Descriptive research design involves a systematic description of facts, qualities or characteristics of a given population or event which factually and accurately answers a given question posed by the problem under investigation (Mugenda & Mugenda, 2003). The study employed both the quantitative and qualitative approaches.

The study focused on schools in Eldoret East District with a population of 151 primary schools having 2803 standard 7 pupils and standard 8 pupils. There are 151 Head teachers (HT) and 193 Mathematics teachers (MT) teaching class 7 and 8.

Clustered and simple random sampling was used to select 3 out of 9 zones. One stage cluster sampling was used to pick head teachers and Mathematics teachers whereby all the elements (schools) in the zones were picked. Cohen & Manion (2008) say that, in one stage cluster sampling the total population is divided into groups known as cluster and a simple random sample of the group is selected. Two stage cluster sampling was used to select pupils. Thirty percent of the 900 pupils (389 standard 7 and 511 standards 8) were selected to represent 270 pupils.

The instruments used to obtain data included the questionnaire, interviews schedule and document analysis.

## 3. Findings and Discussions

### 3.1. Utilization of Materials in Improving Personalized Learning among Learners

The first research objective was to establish the extent of utilization of instructional materials on personalized learning. The researcher sought to investigate the utilization of material in improving personalized learning among learners. The findings obtained from the teacher's questionnaire are presented in Table 1

	Extent of Utilization						
		SD	D	N	A	SA	Total
There is varied instructional materials in the school to suit personalized learning of Mathematics	F	5	13	2	16	4	40
	%	12.5	32.5	5	40	10.0	100
Teachers choose appropriate instructional materials depending on personalized learning among pupils	F	7	15	1	8	9	40
	%	17.5	37.5	2.5	20.0	22.5	100
The teacher's choice of instructional materials has helped in improving personalized learning	F	7	16	-	13	4	40
	%	17.5	40	-	32.5	10.0	100
Mathematics teacher play a crucial role in improving individualized learner instructional materials	F	8	11	1	11	9	40
	%	20.0	27.5	2.5	27.5	22.5	100
The instructional materials are useful in improving individual learning of Mathematics	F	12	7	2	12	7	40
	%	30	17.5	5	30	17.5	100.0
The teaching strategies employed by the teachers are useful in personalized learning among pupils	F	9	13	-	12	8	40
	%	22.5	32.5	-	30.0	20.0	100

Table 1: Utilization of Material in Improving Personalized Learning among Learners

As shown in Table 1 several aspects were considered to measure the concept of utilization. From the findings, some of the utilization concepts researched did support personalized learning whereas others did not support. In relation to varied instructional materials to suit learners 4 (10%) and 16 (40%) teachers agreed and strongly agreed respectively to the fact that there were varied instructional materials to suit learner differences. This finding echoes the findings Stiles (2008) recommendation that, there should be utilization of available instruction materials so long as they are utilized under a well stipulated time frame. On the other hand, though it is important to note that whereas most of the school had these varied materials quite a number of teachers did not utilize these materials to suit individual learners. This is reflected by 7 (17.5%) and 15 (37.5%) of the teachers sampled who strongly disagreed and disagreed respectively that teachers chose instructional materials depending on individual learner needs. According to Ogbodah (2008) study on instructional materials to educate migrant fishermen's children in Nigeria these materials are in exhaustible thus there is no explanation of not using them.

Further information was sought from the teachers to show the crucial role teachers play in improving individual learners' performance. The findings indicate that majority of the teachers 11 (27.5%) and 9 (22.5%) agreed to the fact they played a crucial role. A few teachers 8 (20%) and 11 (22.5%) indicated that teachers did not play this crucial role. In relation to whether teachers have chosen materials with the purpose of improving individual performance in Mathematics the findings indicated that they haven't to a very large extent. This is shown by majority of them 7 (17.5%) and 16 (40%) of the teachers' sampled strongly disagreed and disagreed respectfully. This was higher than the teachers who agreed. Lastly the current research also looked at the usefulness of the strategies employed by teachers to improve individual learner performance. This was consistent with Drake & Sherin (2009) assertion that teachers must first develop their ideas about where the instruction is going mathematically before deciding whether the curriculum materials will help them reach that mathematical goal (curriculum trust)" (P. 325).

The study further investigated whether strategies employed by teachers are useful in personalized learning of mathematics amongst learners. The findings in Table 1 indicate that majority of the strategies used were not useful as represented by 9 (22.5%) teachers who

strongly disagreed and 13 (32.5%) teachers who disagreed. Stein & Kim (2009) points that those teachers who are unable to determine the purpose of the lesson may experience difficulty with facilitating student thinking through the use of those materials (Stein & Kim, 2009). It ought to be noted though that some teachers used these strategies and they were useful as indicated by 12 (30%) teachers who agreed and 8 (20%) teachers who strongly agreed that the teaching strategy employed by teachers are useful in personalized learning. Psacharopoulos (1985) said that it is not enough simply to provide instructional materials such as text books, some efforts must be made to ensure that they are adequately used. Thus, the need for teachers to develop strategies aimed at utilizing the learning materials. It is evident from these findings that majority of the Mathematics teachers did not utilize instructional materials to improve the personalized learning among learners as much as they had the materials available.

In an attempt to look at the utilization of these materials an endeavor was made to look at the perception that teachers had on the usage of mathematical materials and the following themes were found from the transcriptions; Teachers viewed utilization as an activity involving a lot of work. Information from the open-ended question indicated the following: *“it entails teachers doing a lot of work in terms of identifying materials, identifying the students and more so planning in terms of schemes, lessons notes and records of work”*. Further information indicated that, *“It is tiring and there is no time for it. Teachers are a busy lot of people who engage in other activities in school such as being on duty, ensuring that student’s welfare is catered for and offering guidance and counseling. All these coupled with class work that calls for personalized learning for Mathematics will make someone very tired”*. Further information indicated the following, *“teachers are overloaded and are always monitored and forced to cover the syllabus in two terms at most. This in itself discourages the teachers and they result in lecture methods to address the same”*

These sentiments points to the fact that there is teacher apathy towards instructional materials as indicated by Luvisia (2003) who asserted that teachers had negative attitude towards the use of learning resources, he particularly noted over dependence on Kenya Institute of Education (KIE) course books and chalkboards on the use of appropriate books in teaching (Luvisia, 2003). On the contrary though, other teachers had positive perception about utilization with majority saying that, *“it makes Mathematics real in our day to day activities”*. It is evident that teachers had mixed perceptions with others supporting the use of personalized materials while others discouraging the use of the same.

### 3.2. Teachers Skills in the Utilization

The second research objective was to assess the teachers’ skills in utilizing instructional materials on personalized learning of Mathematics in Eldoret East Sub County. The findings are presented in the following sections.

#### 3.2.1. Teachers skills based on Teachers Perceptions

According to Republic of Kenya (2000) *Hand Book for Inspection of Educational Institutions* the importance of the teacher takes second place only to that of the learner thus the skills of the teacher is of great concern to the utilization of instructional material. The researcher sought to investigate the teacher’s skills aimed at improving utilization of instructional materials for personalized learning among learners. The findings are presented in Table 2

Skills required	F	SD	D	N	A	SA	Total
The teacher's skills contribute to the good performance of Mathematics by individual learners	F	4	8	2	12	14	40
	%	10	20	5	30	35	100
The teacher’s delivery skills are useful to the improvement of individual learner’s performance	F	8	10	1	4	17	40
	%	20	25	2.5	10	42.5	100
Seminars and workshops improve individual learners’ performance	F	11	11	2	6	10	40
	%	27.5	27.5	5	15	25	100
The teacher education programs and experience contribute to the improvement of individual performance	F	9	6	-	11	14	40
	%	22.5	15		27.5	35	100
Teacher further studies improve their skills	F	12	13	1	7	7	40
	%	30	32.5	2.5	17.5	17.5	100
Resource persons improve personalized learning	F	11	9	4	8	8	40
	%	27.5	22.5	10	20	20	100

Table 2: Teachers Skills in Utilization

Table 2 indicates that, majority of the teachers 12 (30%) and 14 (30%) concurred that teacher skills are important utilization of materials for personalized learning among learners while a few teachers 4 (10%) and 8 (20%) were of the different opinion. This concurs with studies done by Eggen & Kauchak (2001) who asserted that, where pedagogical content knowledge is lacking, teachers commonly paraphrase information in learners’ textbooks or provide abstract explanations that are not meaningful to their students.

Further information on teachers’ skills indicated that delivery skills were viewed as very important by 17 (42.5%) and 4 (10%) teachers who strongly agreed and agreed respectively against 10 (25%) who disagreed and 8 (20%) who strongly disagreed viewing them as not important. Majority of the teachers 11 (27.5%) strongly disagreed that teachers’ skills acquired through seminars and workshop are not important, 11 (27.5%) disagreed, while 6 (15%) agreed and 10 (25%) strongly agreed that they were important. This is attributed to the fact that majority of the schools do not take their teachers for seminars and workshops. This argument is in line with Kagoda and Ezeti (2014) who concluded in their study on *“Teachers Perception of Professional Development”* that teachers have narrow understanding of the concept, and that teacher professional development meant subject content upgrading by going back

to teacher training college, while others view it as attending workshops and seminars. Barriers mentioned included shortage of time, lack of funds, lack of motivation and support by head teachers and government as a whole.

The present study found out that, attendance of seminars applies to the study because if teachers are not kept abreast of the current theories and methods related to personalized instruction students may be affected. Timperley (2008: 22) suggests that; “engagement of expertise external to the group of teachers is necessary because substantive new learning requires teachers to understand new content, learn new skills and think about their existing practice in new ways”. It is in light of this that, the study highlights the importance of the school administration in developing its teachers. Regardless of the support provided, if teachers feel pressure for their students to excel on procedure-based tests, they may discard standards-based ideas and return to using procedurally based texts to prepare their students for those tests. Similarly, pressure from community members, including parents, to teach children as they were taught may inhibit a teacher’s use of specific materials (Collopy, 2003; Davis & Krajcik, 2005; Remillard, 2000).

Majority of the teachers felt that skills acquired from resource persons may not contribute much as results indicated that 11 (27.5%) teachers strongly disagreed and 9 (22.5%) agreed, whilst 8 (20%) agreed and 8 (20%) strongly agreed. Possible explanation for this is that the resource persons may not have been with the students for long to be able to understand their individual needs. Further information on teachers’ skills in utilizing mathematical instructional materials for personalized learning indicated that skills acquired through teachers’ furthering their studies had majority teachers 12 (30%) strongly disagreeing and 13 (32.5%) disagreeing saying that it doesn’t improve their skills while few teachers 7 (17.5%) agreed and 7 (17.5%) strongly agreed that further studies improves their skills. This is premised on the assumption that teachers further their studies in different disciplines and not necessarily in utilization of instructional materials.

### 3.2.2. Acquisition Skills Required for Utilization

Further inquiry was sought to establish whether teachers had acquired some of these skills so as to enhance personalized learning among learners. The responses are shown in the Figure 1 below.

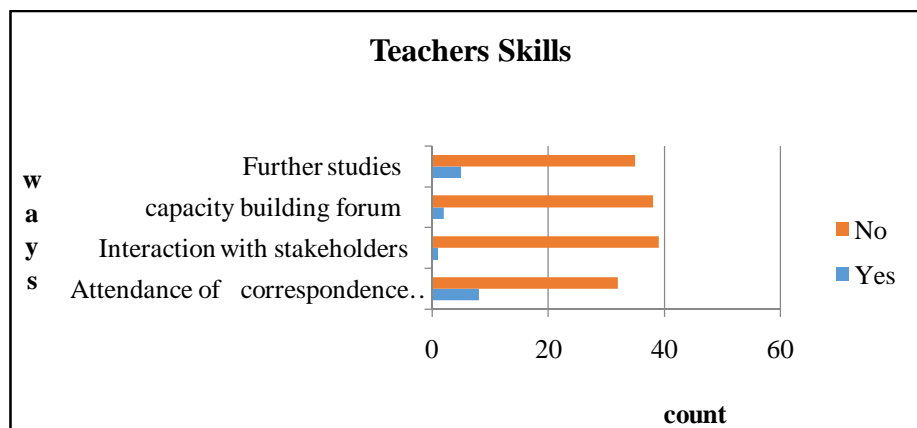


Figure 1: Acquisition of Teachers’ Skills in Utilization

Figure 1 indicates that, 8 (20%) teachers had attended seminars to hone their skills whereas 32 (80%) had not attended, 1 (2.5%) teacher had interacted with stakeholders such as county minister for education, school alumni who have excelled in both private and public sectors while 39 (97.5%) have not interacted. Very few teachers 2 (5%) have had capacity building sessions to improve their capacity. A small number of teachers 5 (12.5%) are undergoing further studies to hone their abilities. It is evident from the data that many teachers may be lacking in terms of the skills necessary for enhancing personalized learning.

## 4. Conclusion

Based on the findings of the study the study concludes that

- i. Majority of the schools had varied instructional materials to suit learner differences though, majority of teachers did not choose materials depending on the individual learners needs. Teachers agreed that they play crucial role in terms of utilization of these materials and materials improved individual performance in Mathematics.
- ii. Skills acquired by teachers were critical in improving the learners’ performance. These skills are to be achieved through the following; seminars and workshops and in-service training. On the contrary though school administration was not facilitating seminars and workshops to enable teachers gain skills thus many teachers may be lacking in terms of the skills necessary for enhancing personalized learning.

## 5. Recommendations

Based on this research, the following recommendations are suggested;

- i. Teachers’ should prepare and utilize Mathematical materials that are well suited to learners needs in order to promote personalized learning.

- ii. Continuous upgrading of Mathematics teacher's skills should be encouraged. The Ministry of Education through key stakeholders such as the private sectors local and international agencies working hand in hand, with individual schools should strive to organize capacity building forums to enhance teacher skills.

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