



FIDELITY TO CLINICAL MODEL CYCLES; A STUDY OF INSTRUCTIONAL SUPERVISION PHASES AND ACTIVITIES AS EXERCISED BY FIELD OFFICER IN EDUCATION

James Mwangi Gathunguⁱ

Associate Faculty,
School of Education,
Mt Kenya University,
Nairobi Campus,
Kenya

Abstract:

Classroom instruction is subject to rational analysis by both the supervisor and teacher, during which, and to maximize positive outcomes, adherence to a model of instruction supervision is crucial. Of the many such models, clinical supervision has gained prominence in literature and use. However, the instructional supervisions practitioner may deemphasize the model's cycle of phases and activities. This study used a non-experimental descriptive quantitative research design to find the extent to which field officers in education adhere to the cycles of phases and activities in their instruction supervision practices when guided by the clinical supervision model. Data was collected through questionnaires and interview schedule administered on secondary school teachers and education officers selected from Kiambu county, Kenya using simple random sampling. Qualitative data was organized into thymes and together with the quantitative data tallied, presented in tables and then analyzed in percentages and averages. The study found that field officers in education were low in fidelity when using the clinical model in their instructional supervision exercises. The study recommends in-servicing of serving teachers and field officers, intensifying training on instructional supervision and applicable of models among teacher trainees.

Keywords: clinical supervision, instructional supervision, field officers, phases of supervision, supervision activities

ⁱ Correspondence: email gathungujm1819@gmail.com

1. Background of the Study

1.1 Introduction

What the teacher intend to do, as evidence in the plan prepared for the lesson, what he actually does in the classroom and the outcomes in terms of what the students do and learn; are subjected to rational analysis by the supervisor and the teacher, an exercise referred to as instructional supervision. According to Glickman, Gordon and Ross (2013), instructional supervision is the action that enables teachers to improve instruction and thereby enhanced provision of quality education to students. Bernard and Goodyear (2014) defines instructional supervision as a process of proper monitoring, making and sharing of observations of a teacher's actions in the classroom with the aim of promoting better intervention that maximize professionalism and learning achievements. Okafor (2012) views instructional supervision as the cycle of activities executed by, and between, a supervisor and a teacher with the objective of improving the teacher's classroom performance, thereby improving students' achievement.

At the heart of instructional supervision is monitoring, sharing of observation, agreeing on, and implementing better interventions with the aim of improving the teaching practices and learning achievement. To effectively achieve this critical role, the supervision need be exercised in a systematic, practical and disciplined way of thinking and doing (Beach and Reinhartz, 2000). This systematic manner in which supervision is applied is called a model, the knowledge of which is fundamental to ethical practicing of instructional supervision (Borders, Glosoff, Welfare, Hays, DeKruyf, Fernando, & Page, 2014). In other words, it's important that an instructional supervision exercise be hinged on a model. The model should offer a clear systematic approach to engagement between the teacher and his/her supervisor. The literature reviewed for this study shows a wide range of models, but with considerable overlaps. However, the conceptual, developmental, contextual, differentiated and clinical supervision models featured prominently.

The Conceptual Supervision model focus on collaborating all components of the school structure in setting benchmarks and adjusting them for the expected organizational change and improvements (Beach & Reinhartz, 2002; Edmeirer & Nicklaus's 1999). *"The Developmental Supervision model engages instructional assistance depending on the teacher's developmental levels, expertise, and commitment"* (Glickman, et al., 2013). The Contextual Supervision focusses on providing instructional support and guidance depending on the teacher's level of skills and readiness. development is in terms of the knowledge, skill, and ability while readiness in terms of the degree of self-assurance (Ralph, 1998).

The Differentiated Supervision model is founded on intensive, cooperative, self-directed, and administrative supervisory option (Glatthorn, 1997). Cooperative professional development involves a mutually respectful group-based process of observation and feedback. Clinical supervision lays clear a systematic cycle of phases each characterized with a comprehensive set of activities and attributes to be exhibited

and carried out in a face-to-face interaction by the participants in an instructional supervision exercise (Pajak 2010). There is consistent evidence that when effectively implemented clinical supervision provides rich opportunities for improving teachers' teaching and students' learning (Burns & Badiali, 2016; Holland & Adam, 2002; Zepeda, 2007). According to Veloo, Macdalena Komuji, and Khalid (2013), among others, the systematically phases built into the clinical supervision has made the model gain preference of use among both internal and external supervisors of instruction at school level.

However, Oduro (2008) and Opare (2009) notes that falling standards in education world over, especially in public schools can be justifiably attributed to weak, inadequate and ineffective supervision. According to Hunzicker, (2011) and Vescio, Ross, & Adams, (2008) among the numerous explanations for the poor supervision in schools is the choice and application of the supervision approaches. Though many supervisors tend to adopt clinical supervision model, Borders, et, al., (2014), identifies that the users tend to de-emphasize the actual tasks involved in the model. Consequently, the model is not administered adequately, hence the minimal positive impact on outcomes of instructional supervision. A study by Dangel and Tanguay, (2014) confirmed teachers' dissatisfaction on instructional supervision that government officers and heads of institutions undertook as they were random, haphazard, and rarely based on factual observation. Baharom (2002) found that among other misapplication, the use of clinical supervision models tends to be random in phases and overstepping as opposed to being systematic and comprehensive.

1.2 Statement of the Problem

Though the 21st century teacher have become more analytical and embracing of contradicting but constructive appraisal of their instructions in the classroom, they continued being faced with multiple challenges which instructional supervision is unable to alleviate. For effectiveness, instruction supervision need to be guided by a well thought out systematic process, such as that which is provided by the clinical supervision model. Study by Baharom (2002) found that among other misapplication, the use of clinical supervision models tends to be random in phases and overstepping as opposed to being systematic and comprehensive. In Kenya, education officers are the filed officers in education who carry out the role of external supervisors of instruction at school level.

1.3 Purpose of the Study

Assuming that field officers in education are guided by model, the study set out to find out the extent to which such officers adhere to the cycles of phases and activities in clinical supervision model when exercising their role as external supervisors of instruction at school level.

1.4 Objectives of the Study

- 1) To find out the instructional supervision model commonly used by field officers in education when exercising their role as external supervisors of instruction at school level
- 2) To identify the extent to which field officers in education as external supervisors adhere to the systematic cycle of phases when exercising their role as external supervisors of instruction at school level
- 3) To identify the extent to which field officers in education adhere to the logical set of supervisory activities in the clinical model when exercising their role as external supervisors of instruction at school level

1.5 Questions of the Study

- 1) What is the commonly used instructional supervision model among field officers in education when exercising their role as external supervisor of instruction at school level?
- 2) To what extent do field officers in education adhere to the systematic cycle of phases when exercising their role as external supervisors of instruction at school level?
- 3) To what extent do field officers in education adhere to the logical set of supervisory activities in the clinical model when exercising their role as external supervisor of instruction at school level?

1.6 Definition of Terms

- **Model of instructional supervision:** The systematic manner or approximate map of reality in which instructional supervision is applied in practice
- **Field officers in education:** Education officers stationed and representing the state department of education at a country's smaller administration units such as county or sub county, whose one of the key roles is to visit schools occasionally and observe a teacher instructional behaviour in the classroom with the aim of assisting, guiding and directing on improving the teaching
- **Instructional supervision:** An interaction in which a person uses his/her expert knowledge and experiences in teaching and learning to observe and evaluate a teacher instructional behaviour in a classroom, and use what is observed to guide the teacher improve his/her teaching and learning activities.

1.7 Limitations of the Study

This study is primarily on the extent to which field officers adhere to the cycles of phases and activities in clinical supervision model when exercising their role as external supervisors of instruction at school level. The major limitation encountered was that some participants were reluctant as they imagined that the study was meant to appraise their instructional and supervision skills in general and use of clinical supervision as a model of instructional supervision in particular. However, upon being assured that the

information they provided was for the purpose of this study only, they willingly participated

1.8 Delimitations of the Study

The data for this study constitutes responses given by teachers randomly selected secondary schools and educational officers drawn from Kiambu, one of the 47 administrative counties in Kenya with the hope that the findings are generalizable to other counties and countries. While remaining cognizant that there are many models of instructional supervision, the study focused on clinical supervision. Though clinical supervision is more than a set of procedures and actions, this study only focused on the cycle of phases and activities prerequisite to effective use of the model. The pedagogical expertise among instructional supervisors was presumed present as they are assumed to be education officers many of whom are deployed from among teachers as part of career progression.

1.9 Significance of the Study

The goal is to encourage the field officers in education and classroom teachers to develop and enrich not only their knowledge and skills in instruction and supervision but also accuracy in observing the cycle of phases and activities in the logical way that clinical supervision model prescribes.

2. Literature Review

2.1 Introduction

This section reviews the literature related to the key attributes of the models of instructional supervision, namely the Clinical, Conceptual, Developmental, Contextual, and Differentiated Supervision. Emphasizes is paid to the use, cycle of phases and supervisory activities related to clinical model, the focus of this study. Each part of the literature review is underlined with the objective of the study relevant to the section.

2.2 Use of Clinical Supervision

To effectively play the crucial role embodied in instructional supervision, teachers and their supervisors need engage in a systematic, disciplined, and practical approach of thinking and doing the task. Using the right instructional supervision model, supervisors are able to support teachers to effectively translate instructional plans and programmes for better learning achievements (Sergiovani and Starratt, 2002). Among the wide range of instructional supervision models that features prominently in literature are clinical, conceptual, developmental, contextual, and differentiated supervision models.

The Conceptual Supervision model focus on all the components of the school structure as influencing the performance of the teacher. The supervisor and the teacher collaborate in setting benchmarks to be met by the teacher, organizational and personal factors adjusted in support of the expected change and improvements toward the

benchmarks evaluated in each supervisory visit (Beach & Reinhartz, 2000; Edmeirer & Nicklaus, 1999). The Developmental Supervision model engages directive, collaborative, and nondirective assistance depending on the teacher or group's developmental levels, expertise, and commitment (Gebhard, 1990; Glickman, et al., 2013). This model advocates that at earlier stages of development, teachers are to be put under directive supervision, at moderate level of development are matched with collaborative assistance while those of proven high expertise and commitment are subjected to nondirective assistance.

The Contextual Supervision focusses on providing instructional support and guidance to teachers depending on his/her level of development and readiness. The development is in terms of the knowledge, skill, and ability while readiness focusses on the degree of self-assurance, willingness, motivation, interest, or enthusiasm to engage in the task (Gebhard, 1990; Ralph, 1998). In contextual supervision the instructional support and guidance feedback to the teacher is given only if there were any immediate concerns. The Differentiated Supervision model provides a set of four distinct supervisory option from which the teacher chooses and focus on one where he/she need to improve on and the supervisor comes in as a mentor (Glatthorn, 1997). The options are intensive development, cooperative professional development, self-directed, and administrative monitoring. In intensive supervision, the supervisor carries out a series of instructional observation focusing on teaching outcomes rather than teaching methods. When using differentiated supervision, the cooperative professional development should involve a mutually respectful process in which a small group of teachers observe each other's' classes and give feedback on the teaching behaviour. In self-directed option, a teacher independently develops and carries out plans for his/her professional growth with the instructional leader as a resource and mentor. With the administrative monitoring, the instructional leader makes brief, unannounced classroom visits to monitor the teachers instructional behaviour to keep the supervisor aware of any problems the teacher might be having.

According to Goldhammer et al. (1993) clinical supervision is a model of face-to-face interaction between the teacher and supervisor involving a systematic cycle of planning, observation, intensive analysis of the teacher's instructional behaviours, provision of feedback and reflection on the process as a whole. There are specific activity sets to be accomplished in each of the phases. The systematic cycle of phases and specific activity sets are among the basic values that makes the model attractive for use in instructional supervision (Burns and Badiali, 2016; Veloo, et al., 2013; Nolan and Hoover 2004). Table 1 presents an analysis of the five models of instructional supervision on three key areas, namely cycle of activities engaged, approach applied and action taken as drawn from literature review.

Table 1: Key characteristics or principles
 of the five models common in instructional supervision

	Cycle of activities	Approach used	Action taken
Clinical Supervision	Every cycle of instructional supervision goes through a series of systematic phases of planning, observation, analysis of instructional behaviour, feedback and reflection of the process; the end of which informs the next cycle	Joint problem solving aimed at improvement of a teachers instructional strategies	There is reflection and analysis of effective and ineffective instructional strategy through actual classroom observation
Conceptual Supervision	Analysis of all school components as influencing a teacher’s instructional behaviour, setting of benchmarks and adjusting organizational and personnel factors	Teacher independently works on improvement benchmarks that are cooperatively set with the supervisor	Organizational and personal factors adjusted in support of the expected change and improvements toward the benchmarks evaluated in each supervisory visit
Conceptual Supervision	Pay attention to the teachers readiness in terms of degree of self-assurance, willingness, motivation, and enthusiasm to engage in the teaching and supervision	Guidance and support given depends on teacher’s level developmental in knowledge, skill, and ability	Supervisory feedback to the teacher is only given if there were any immediate concerns
Developmental Supervision	Varies supervision approaches between directive, collaborative, and nondirective assistance depending on whether the teacher is a novice, moderate or an expert in skills	The instructional supervisor takes a more passive role in listening, reflecting, clarifying, encouraging, and problem solving	Recognizes that teachers or groups are at different levels of skill developmental each characterized by unique and different challenges
Developmental Supervision	Peer group observation on teacher’s instructional behaviours, giving feedback then teacher independently develop and carry out the improvement plan. Supervisor mentor the teacher through the process.	The mentoring, group observation, feedback, and improvement plan and action, teaching outcomes instead of teaching methods.	Teacher independently develops and carry out plans for his/her professional growth on an areas of concern with the instructional supervisor as a resource and mentor

Effective application of the clinical supervision model strongly hinges on among other factors, the clear understanding and mastery of the systematic cycle of phases and supervisory activities prescribed and if de-emphasized, the fidelity in using the model is open to doubts (Borders, et. al., 2014; Eraslan, 2009; Neal & Dawn, 1995). While agreeing that clinical supervision offered rich opportunities for improvement in instructional performance, a study by Baharom (2002), reported that 12.03% primary school teachers and 5.88% secondary school teachers perceived clinical supervision as being inadequately used. This study set out to find out the instructional supervision model commonly used by field officers in education when exercising their role as external supervisors of instruction at school level

2.3 Systematic Cycles of Phases

Though scholars such as Glanz, Shulman and Sullivan (2005) among others have suggested different phases in clinical supervision cycle, the five stages of pre-supervision conference, classroom observation, analysis and strategy setting, post-supervision conference; and post-supervision analysis by Goldhammer, Anderson, & Krajewski, (1993) attracts favourable review in literature and preference in application. The phases are logically arranged, each having a set of activities that must be accurately and methodically followed as a platform for a success instructional supervision exercise (Burns and Badiali, 2016). There are those specific to the supervisor, the teacher or both. The key to success when using clinical supervision in instructional supervision lies in accuracy and effectiveness facilitation of all these phases in a comprehensive and logically seamless order (Burns and Badiali, 2016; Holland & Adam, 2002). Studies by Baharom (2002) found that in using clinical supervision models some instructional supervisors tend to be not only random in phases, but also disregards some though crucial.

The first phase when using clinical model in instructional supervision is pre-supervision, also referred to as pre-observation conference, or planning phase. It is a conference phase between the supervisor and the teachers held at the school of focus to cooperatively plan and discuss the purpose and instruments to be used, and in so doing builds consensus on the whole supervision process (Goldhammer, *et al.*, 1993; Glanz *et al.*, 2000). Classroom observation, where the supervisors observes the teacher present a lesson in a real classroom setting, comes next. The observation is meant to explicitly identify and objectively capture the realities of the teaching in a way that the teachers and his/her supervisor can reconstruct and analyses the lesson as validly as possible afterwards.

The classroom observation feeds into the third phase referred to as analysis and strategy setting. Here the supervision team collates, and review the observation data, coming up with a memorandum of ratings, patterns incidences and performance reflective of the purpose of the supervision. They also come up with a proposed plan of the conference phase and the remedial actions thereafter (Sarfo and Cudjoe, 2016). The fourth phase is the post-observation conference, during which the supervisor helps the teacher to internalize the patterns, events and incidences that occurred during the classroom instructions and communicate the rating of the performance in the classroom. Means to strengthen the instructional practices are also agreed upon (Arcario 1994; Goldhammer, *et al.*, 1993; Richardson, 2011). Lastly there is the post-supervision analysis, a phase of self-reflection for both the teacher and the supervisor on how well the cycle went, what worked well and what did not.

Hunzicker (2011); Sergiovani and Starratt (2002) proposes that among the numerous explanations fronted for the poor supervision in schools is the inappropriate adherence to the system approach built in the model chosen. In particular, Baharom (2002) found that among other misapplication, the use of clinical supervision models tends to be random in phases and overstepping as opposed to being systematic and

comprehensive. This study set out to identify the extent to which field officers in education as external supervisors adhere to the systematic cycle of phases when exercising their role as external supervisors of instruction at school level.

2.4 Compressive Cycle of Activities

The phases in clinical supervision model are logically arranged, each accomplished through a set of activities that need be accurately and methodically accomplished. The key to success when using clinical supervision in instructional supervision lies in facilitating all these activities in a comprehensive and logically seamless order (Burns and Badiali, 2016). Studies by Baharom (2002) found that in using clinical supervision models some instructional supervisors tend to be random or selective in the activities they accomplish.

In the pre-supervision, the supervisor and teachers cooperatively draw and discuss the schedules, purposes, foci and plan for the day (Goldhammer, et. al., 1993; Sullivan, 2000). The teacher explains to the supervisor the planned topic and content for lessons to be observed, the way he/she intends to handle the class, and the desired learning outcomes. The supervisor on the other hand asks probing and clarifying questions in order to be clear about the expectations. The observation, done in a real classroom situation with both the supervisor and the teachers physically present, the teacher teach, while the supervisor observes and comprehensively capture the details on the realities of teacher's behaviours and their immediate effect on the learner and learning (Okafor, 2012; Neal & Dawn, 1995). The supervisor is to only record the patterns and critical incidents reflective of the objective, content and strategies planned for the lesson as well as the purpose of the instructional supervision exercise (Gebhard, 1990).

Consolidation of data generated from the classroom observations is one of key activities in the analysis and strategy setting stage. The data is collated into patterns and incidences in line with the purpose of the supervision, then examined and interpreted in terms of strengths and weaknesses the teacher exhibited, techniques that were especially successful and those that were not, as well as the patterns, events, and concerns that need to be addressed. The teacher's performance in the classroom instruction is graded as per the initially agreed upon ratings and a plan on how the post-observation conference begin and ends, what to discuss in the gathering and with individual teachers is drawn (Richardson, 2011; Sarfo and Cudjoe, 2016).

The activities in the post-observation conference includes communicating the rating of the teacher performance in the classroom, discussing the teacher's instructional behavior patterns, events and incidences that occurred in the classroom. There is also the developing and agreeing on the means to strengthen the instructional practices (Richardson, 2011). According to Arcario (1994) the post-observation conference should generally begin with small talk to put the teacher at ease and be receptive to the discussion at hand. This is followed by an opening move which pave way for serious discussion. As the teacher critique the lesson, the supervisor listens, probe and validate

the teacher's perceptions by paraphrasing his/her understanding of the messages and asking for clarification and justification when necessary.

In the last phase, post-supervision phase, the activities are fundamentally self-reflection in terms of how well the cycle went, what worked and what did not. The planned remedial actions to improving instruction and supervision endeavors are implemented. In the process of doing so, the teacher critically analyzes his/her response to the instructional supervision and effect the improvement alternatives agreed upon. On the other hand, the supervisor methodically scrutinizes his/her behavior and performance during the supervision cycle, draws out the areas of improvement and explores on strategies for better results during subsequent clinical supervision cycles (Sergiovanni & Starratt, 2003).

World over, the concern raised on falling standards in education especially in public schools has been attributed though partly, to inadequate supervision (Oduro 2008; Opare, 2009). Studies shows that in United State of America a teacher is supervised only once and 69% of the teachers are inadequately supervised (Pajak (2010). Paker (2008) studied instructional supervision among teachers in Turkey schools, and found that the exercises were low in number of supervision activity attended to and poor participation among teachers was common. Another study by Richardson (2011) confirmed teachers' dissatisfaction with instructional supervision as the exercises lacked in variety of activities making inclusive participation by both the teachers and supervisors elusive. This study was carried out to identify the extent to which field officers in education adhere to the logical set of supervisory activities in the clinical model when exercising their role as external supervisors of instruction at school level.

3. Methodology

3.1 Introduction

This section presents the research design, and methods, data collection instruments, and procedures of data organizations and analysis. The target population, sampling procedure, unit of observation and unit of analysis are also presented.

3.2 Research Design

The study used a non-experimental descriptive quantitative research design to describe the model of instruction supervision, the cycle of phases and supervision activities that field officers in education engage in while carrying out their instructional supervision mandate; by using qualitative data generated from a set of questionnaires administered and interview conducted on participants (Corbin, & Strauss, 2008). The data was gathered and analysed without manipulating the variables of study, hence a non-experimental study.

3.3 Target Population

Classroom instruction is the key role of the teacher while one of the traditional role of education officers in Kenya is instructional supervision of the teachers at school level. Therefore, both the teachers and education officers are key participants in instructional supervision. The study was carried out in Kiambu county Kenya, and generalized to all field officers in education who have instructional supervision at school level as one of their mandates in their line of duty.

3.4 Sample Size and Sampling Procedure

This study focused on the experiences of twenty-three education officers, and one hundred and fifty teachers who had participated in at least two instructional supervision exercises in the year preceding the study. The key rationale for choosing the education officer to participate was that one must have participated in at least two instructional supervision exercises in the administrative area of the study in the year preceding the research study. The education officers were selected using simple random sampling and upon consent to participate, they were asked to specify the schools they had visited for instructional supervision. Names of teachers from the schools mentioned were then obtained, each put on a piece of paper and placed in one box. The papers were then shuffled in the box and picked at random. A teacher's name picked was included as a member of the sample. This exercise was repeated until the sufficient sample size was reached. Each teacher was then approached for consent to participate in the study. In event of negative response, a further name was drawn for replacement. Only two education officers and four teachers were replaced this way.

3.5 Research Instruments

A structured question form consisting of both open and close ended questions and an interview schedule both developed by the researchers were used to collect the data meant to reveal the views of teachers and education officers about the use of clinical supervision model, cycle of phases and supervisory activities that field officers in education adhered to when exercising their role as external supervisors of instruction at school level. The forms were distributed and collected a week after, by the researcher. According to Corbin and Strauss, (2008) using meeting technique is instrumental in understanding feelings and ideas of interviewed people as it helps to collect deeper information. The study used an interview schedule that provided a list of questions that guided the researcher through the oral interview. The interview was conducted on 10 % of the participants namely three education officer and 15 teachers over a period of one weeks, during which the researcher met the interviewee individually.

3.6 Data Collection Procedure

Data was collected from both teachers and education officers. A participant either completed a questionnaire or was interviewed to give his/her experience relating to the presence or absence of the activities that defined the model used, cycle of phases and

activities in the instructional supervision they had experienced. The questionnaires were distributed by the researcher and collected a week after. The researcher conducted the interview with the individual participant, which took a period of two weeks. The use of questionnaires and interview schedule on both teachers and education officers provided multiple sources of data and data collection instruments thus accomplishing the need for triangulation.

3.7 Data Analysis and Presentation Techniques

First the questionnaires were checked for completeness and the data carefully analyzed to eliminate all subjectivity. In order to identify and assemble recurring themes into exhaustively mutually exclusive, and conceptually congruent categories reflective of the purpose of the research, the analysis of interview responses started immediately after the first interview. The researcher read and wrote reflective notes to help adjust the interview strategies, items and categories that could enrich data collection, classification and sorting. In so doing, more relevant and deeper understanding of emerging ideas, checking and testing were developed (Corbin, & Strauss, 2008).

To guide in meaningful explanation and interpretation of key trends or patterns, the data was organized in tables and charts then described using percentages, mean, and mode. The quantitative data from the interview and open-ended sections of the questionnaires were arranged thematically, from which the main themes and patterns in the responses were identified, and tallied. These was then combined with the qualitative data from the questionnaires and presented in frequency tables, percentages and averages. For the purpose of this study, an average figure was computed from the observed data and used as the measure of adherence to the cycle and collaboration elements of clinical model in instructional supervision.

4. Results and Discussions

4.1 Use of Clinical Supervision

From the literature reviewed, each of the five models emerging as being prominently used in instructional supervision, have its unique and inherent attributes, in absent which of which a field officer would not purport to be using the model. To find out the model common among the field officers in education while supervising instruction at school level, the researcher narrowed down each of the model to three key attributes as guided by the literature reviewed. The characteristics were presented tot eh participants in alphabetical order of the statements used, and not the models they represented. The participants were asked to tick at least three key attributes they observed to have guided the instructional supervision exercises they had been party to. The responses given were tallied, ranked and organized by the model they represented. Cumulative frequency for each model was also computed. Table 2 shows the characteristics observed by teachers and education officers as present in instructional supervision exercises they had been involved in.

Table 2: Common characteristic observed in instructional supervision exercises as reported by the teachers and education officer

Model	Characteristic of supervision approach	Teachers			Education officers		
		<i>f</i>	%	<i>Rank</i>	<i>f</i>	%	<i>Rank</i>
Clinical Supervision	Every cycle of supervision goes through a series of systematic steps, the end of which informs the next	51	12.3	1	10	14.7	1
	Reflection and analysis of effective and ineffective instructional strategy and actual classroom observation	39	9.4	3	8	11.8	2
	Joint problem solving aimed at improvement of a teachers instructional strategies	33	8.0	4	7	10.3	4
	Tally	123	29.7	1	25	36.8	1
Conceptual Supervision	Teacher independently works on improvement benchmarks cooperatively set with the supervisor	42	10.1	2	8	11.8	2
	Organizational and personal factors adjusted to support expected change and improvements identified	30	7.2	6	6	8.8	5
	Focus on all the components of the school structure as influencing a teacher's instructional behaviour	24	5.8	8	3	4.4	8
	Tally	96	23.2	2	17	25.0	2
Contextual Supervision	Supervisory feedback to the teacher is only given if there were any immediate concerns	33	8.0	4	6	8.8	5
	Guidance and support given depends on teacher's level of professional developmental, knowledge, skill, and ability	24	5.8	8	3	4.4	8
	Pay attention to the teacher's readiness, in terms of degree of self-assurance, willingness, motivation, and enthusiasm to engage and improve in the teaching and supervision	21	5.1	11	2	2.9	12
	Tally	78	18.8	3	11	16.2	3
Developmental Supervision	Varies approaches between directive, collaborative, and nondirective assistance depending on whether the teacher is a novice, moderate or an expert in skills	24	5.8	8	3	4.4	8
	Recognizes that teachers or groups are at different levels of skill developmental each characterized by unique and different challenges	21	5.1	11	4	5.9	7
	Instructional supervisor takes a more passive role in listening, reflecting, clarifying, encouraging, and problem solving	18	4.3	13	2	2.9	12
	Tally	63	15.2	4	9	13.2	4
Differentiated Supervision	Teacher independently develop and carry out plans for his/her professional growth on an areas of concern with the instructional supervisor as a resource and mentor	27	6.5	7	3	4.4	8

	Small group of teachers observe each other's classes and give feedback in a mutually respectful process	18	4.3	13	2	2.9	12
	Supervisor mentors the teacher through a series of instructional observations focusing on teaching outcomes instead of teaching methods	9	2.2	15	1	1.5	15
	Tally	54	13.0	5	6	8.8	5
		414	100		68	100	

The study found that observing a cycle of series of systematic steps, the end of one cycle informing the next was the characteristic most observed in instructional supervision as it was reported by 51 (12.3%) teachers and 10 (14.7%) education officers. Responses from the teachers ranked the three characteristics in clinical supervision model at position 1, 3 and 4 with a frequency of 51 (12.3%), 39 (9.4%) and 33 (8.0%) respectively. The same characteristics were ranked at positions 1, 2, and 4 by the Education officers at a frequency of 10 (14.7%), 8 (11.8%), and 7 (10.3%). The cumulative frequency showed a high presence of characteristics of clinical model in instructional supervision exercises as they were reported by 123 (29.7%) teachers and 25 (36.8%) education officers. Conceptual Supervision come in second with 96 (23.1%) among the teachers and 11 (16.2%) of the Education officers. The characteristics common in Contextual Supervision model had the third highest cumulative frequency and those in Developmental Supervision come in forth. The Differentiated Supervision came in fifth at 54 (13.0%) for the teachers and 6 (8.8%) for the education officers. From the cumulative frequency on the presence of the sets of characteristics representing each of the five model, the study noted the characteristics that made up the clinical supervision model to have the highest observations. Therefore, the study found that clinical supervision was the most preferred model among field officers in education when supervising instruction at school level. These findings agree with the assertion made by Veloo, et. al., (2013) that the appealing features built into the clinical supervision model attracts its wide use among instructional supervisors.

4.2 Systematic Cycles of Phases

When using the clinical model, there is a set of five logically arranged phases that one need to adhere to. These are pre-supervision conference, classroom observation, analysis and strategy setting, post-supervision conference and post-supervision analysis. To identify the extent to which field officers in education adhere to the systematic cycle of phases when supervising instruction at school level, both the teachers and education officer were asked to list the steps they observed in use during the instructional supervision exercise they engaged in. The phases were listed as reported by the respondents before organizing them into thymes that closely related to the phases identified in the models of supervision reviewed in the literature. The phases were then tallied and presented in a frequency distribution. Table 3 shows the phases that teachers

and education officers reported to observed in the instructional supervision exercises they participated in.

Table 3: Phases of instructional supervision process exercised by field officers in education as reported by teachers and education officers

Phases Observed	Teachers			Education officers		
	<i>f</i>	%	Rank	<i>f</i>	%	Rank
Planning for the supervision while at the school whose teachers are to be supervised	21	14.0	8	3	13.0	8
Observing the teacher teach in an actual classroom environment	141	94.0	1	21	91.3	1
Studying the data collected and writing the teams report to be delivered to the teachers	114	76.0	4	18	78.3	4
Presenting the report of findings to the teachers immediately supervision is done	121	80.7	3	20	87.0	2
Reviewing or reflecting on the supervision process as a whole	29	19.3	7	8	34.8	6
Gathering data from classroom observation conducted by the school administrators	66	44.0	5	10	43.5	5
Planning for the supervision done by supervisor before moving into the school of focus	127	84.7	2	19	82.6	3
Supervision only presented and discussed with the school principal	61	40.7	6	6	26.1	7
Total	680			105		

The planning for the instructional supervision was done at school as reported by 21 (14.0%) of the 150 teachers and 3 (13.0%) of the 23 education officers, while 127 (82.7%) of the teachers and 19 (82.6%) of the education officers reported that planning as done by the supervisors before coming into the school for supervision. Observing the teacher teach in the classroom was the most observed phase as reported by 141 (94%) teachers and 21 (91.3%) education officers.

The study found that instructional supervisors tend to exercise instructional supervision in varying cycle of up to 8 phases. Among the five phases teachers and education officers reported as most observed, three namely; observing teachers teach, presenting the report to teachers, studying the data collected and writing the report were characteristics of the clinical supervision model. The other two were planning for instructional supervision before moving into the school of focus, and gathering data from classroom observation conducted by the school administrators. The findings imply that external supervisors ignored some critical phases while others engaged in phases that were unnecessary. The findings agree with those in the studies conducted by Baharom (2002) that the use of clinical supervision models in instructional supervision tend to ignoring some phases though crucial to effective instruction supervision.

The reliance on classroom observation data gathered by the school administrators was reported by 66 (44.0%) teachers and 10 (43.5%) education officers. Such actions deprive the instructional process the opportunity for generating reliable data on teachers instructional behaviours. This finding shows that field officers in education do fail in enhancing face-to-face interaction between themselves and the teacher in the work contexts, as required of anyone using clinical supervision model as advocated by Hunzicker, (2011).

4.3 Cycle of Activities

Each of the five phases in clinical supervision has activities that needs to be methodically executed as a platform for success when supervising instruction. According to Burns and Badiali, (2016), the key to success when using the clinical model in instructional supervision lies in accuracy and effective facilitation of the supervision activities in a comprehensive and logically seamless order. To identify the extent to which field officers in education adhere to the logical set of supervisory activities in the clinical model when supervising instruction at school level, both the teachers and education officers were given a list of activities and asked to tick the ones they engaged in during instructional supervision. Each phase of instructional supervision cycle was represented by a set of three activities the study had identified as key to the success of an instructional supervision process when using the clinical model. Table 4 shows the activities that teachers and education officers reported as having been engaging in during the instructional supervision exercises they had been party to.

Table 4: Activities teachers and education officers engaged in during instructional supervision exercises

Phase	Activity	Teachers				Education officers			
		Done		Not Done		Done		Not Done	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Pre-supervision phase	Reviewing the instructional supervision schedules and observation instruments for the day	11	7.3	139	92.7	1	4.35	22	95.7
	Reviewing the purposes and foci of the instructional supervision	27	18.0	123	82	5	21.7	18	78.3
	Clarifying the planned purpose, content, teaching strategies and learning outcomes for the lesson	14	9.3	136	90.7	2	8.7	21	87.3
Classroom observation	Supervisors physical presence in classroom as teacher teach	141	94.0	9	6	21	91.3	2	8.7
	Teacher present the lesson uninterrupted	132	88.0	18	12	19	82.6	4	17.4
	Observation strictly done on the areas specified in the data collection instruments	37	24.7	113	75.3	9	39.1	14	60.9
Analysis and strategy	Review and consolidation of all the data collected from classroom observation	147	98.0	3	2	21	91.3	2	8.7
	Grading/rating the teacher's performance for the lesson observed, and recommendation for improvement	131	87.3	19	12.7	20	87	3	13
	Draws a plan on how the post-observation conference begin and ends, what to discuss in the gathering and with individual teachers	69	46.0	81	54	1	4.35	22	95.7
Post-observation conference/	Small talk to put people at ease and be receptive	11	7.3	139	92.7	2	8.7	21	91.3

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 PHASES AND ACTIVITIES AS EXERCISED BY FIELD OFFICER IN EDUCATION

Feedback/ Sharing of knowledge	Discussion and clarifying teachers instructional behavior patterns, events and incidences observed in the classroom	59	39.3	91	60.7	7	30.4	16	69.6
	Communicate the rating of the teacher performance in the classroom	136	90.7	14	9.33	21	91.3	2	8.7
Post-supervision analysis or reflection	Drawing a tentatively plan for instructional improvement	25	16.7	125	83.3	4	17.4	19	82.6
	Self-reflection/analyzing self and other's behaviour, performance and response to the instructional supervision	3	2.0	147	98	0	0	23	100
	Ensuring and taking remedial actions towards improving future instructional supervision endeavors	11	7.3	139	92.7	2	8.7	21	91.3

At the pre-observation phase, 27 (18%) teachers and 5 (21.7%) education officers agreed to have engaged in reviewing the purposes and foci of the instructional supervision. The other two activities had low rate of occurrence as they were reported done by less than 10% of the teachers as well as education officers. The study found physical presence of supervisors in the classroom to observe the teacher teach a common practice among instruction supervisors as it was reported as done by 141 (94.0%) teachers and 21 (91.0%) education officers. However, 37 (24.7%) teachers and 9 (39.1%) education officers reported that instructional supervisors didn't restrict their observation to the areas specified in the observation schedule. Drawing a plan on the post-observation conference was the activity least attended to in the analyzes and strategy setting phase of instructional supervision as it was reported not done by 81 (54.0%) teachers and 22 (95.7%) education officers.

The study found that the post-observation conference tended to concentrate more on communicating the rating of the teacher performance in the classroom as it was reported done by 136 (90.7%) teachers and 21 (91.3%) education officers. The frequency of engaging teachers in small talks to put them at ease so as to be receptive of the feedback was largely ignored as it was reported not done by 139 (92.7%) teachers and 21 (91.3%) education officers. The study found that activities in the post-supervision analysis and reflection were largely ignored, as none was reported as done by more than 20% of either the teachers or education officers.

The findings imply that there exist incidences where field officers in education ignored some of the instruction supervision activities that should be executed when using clinical model. Such actions inevitably compromise the level of involvement and support that teachers get during instruction supervision. This finding agrees with the study by Paker (2008) that teachers find instructional supervision process incomprehensive, and unable to provide the support they required in seeking solutions to the instruction challenges they experienced. It also agrees with the findings by Baharom (2002) that in

using clinical models in instructional supervision, supervisors tended to ignore some crucial supervision activities.

5. Summary, Conclusions and Recommendations

This study was an attempt to find out the extent to which field officers in education adhere to clinical supervision model when exercising their instructional supervision role at school level. The goal of the first research question was to find out the instructional supervision model commonly used by field officers in education when exercising their role as external supervisors of instruction at school level. The characteristics found most common among field officers in education in supervising instruction at school level were observing systematic cycle of phases, reflective analysis of observed instructional behaviours, and joint problem solving. These are the three key characteristic of clinical supervision model. The study concluded that clinical supervision is the most commonly used model among field officers in education when exercising their role as external supervisors of instruction at school level.

The second research question sought to identify the extent to which field officers in education as external supervisors adhere to the systematic cycle of phases when exercising their role as external supervisors of instruction at school level. The study found that supervisors failed to accurately adhere to the phases set in clinical supervision model by either omitting, replace or de-emphasizing some steps and in some cases adding more. There are those who planned from their offices and not involving the teachers. Others relied on observation data generated by the school administration hence avoid face-to-face observation of the teachers in the classroom. There those who presented their findings to the administration and not to the teachers thereby denying the teachers the opportunity to seek clarification on the observations and rating. The study concluded field officers in education had low level of adherence to the systematic cycle of phases in clinical model when supervising instruction at school level.

The third research question focuses on identifying the extent to which field officers in education adhere to the logical set of supervisory activities in the clinical model when exercising their role as external supervisors of instruction at school level. The study found that reviewing the instructional supervision schedules for the day and the observation instruments to be used, clarifying the purpose, content, teaching strategies and learning outcomes in the lesson plan for the lesson to be observed, engaging teachers in small talks put them at ease hence make them receptive and self-reflection on ones behaviour, performance and response during the instructional supervision were the four activities that were largely ignored. The study concluded that field officers in education were low in adhering to the logical set of supervisory activities in the clinical model when exercising their role as external supervisors of instruction at school level.

5.1 Recommendations

Consequently, the study recommends for school improvement to be realized and standards of education to be improved, there should be thoughtful enhancement of training on instruction supervision. Field officers should be encouraged to research widely on the models of supervision and practice effective use of the same, engage more in strategic seminars, workshops, and exchange programs related to instruction supervision. Both teachers and the field officers should be encouraged to shift their perceptions of instructional supervision as an administration demand and engage as a prerequisite tool for bettering their field and classroom practice, which ultimately lead to professional growth and better learning achievement among their learners.

About the Author

The author is career teacher in Business Studies and a Lecturer in Curriculum Studies and Instruction. He holds a PhD, MEd degree in Curriculum Studies, a Bachelors of Art degree, Diploma in Human Resource Management and a Postgraduate Diploma in Education. He is a member of Society of Educational Research and Evaluation in Kenya (SEREK) with research interest in areas of curriculum development, implementation, innovation and evaluation.

References

- Arcario P, 1994. Post-observation conferences in TESOL teacher education programs. PhD Thesis. Teachers College, Columbia University, New York, NY.
- Beach D, & Reinhartz J, 2000. Supervisory leadership: Focus on instruction, Allyn & Bacon, Boston.
- Bernard J, Goodyear R, 2014. Fundamentals of clinical supervision 5th ed.. Boston, MA: Pearson.
- Borders L, Glosoff H, Welfare I, Hays G, DeKruyf L, Fernando D, Page B, 2014. Best practices in clinical supervision: Evolution of a counseling specialty. *The Clinical Supervisor*, 33 1, 26-44.
- Burns R, Badiali B, 2016. Unearthing the complexities of clinical pedagogy in supervision: Identifying the pedagogical skills of supervisors. *Action in Teacher Education*, 382, 156-174.
- Corbin J, Strauss A, 2008. Basics of qualitative research 3rd ed.. Thousand Oaks, CA: Sage.
- Dangel J, Tanguay C, 2014. "Don't leave us out there alone": A framework for supporting supervisors. *Action in Teacher Education*, 361, 3-19.
- Edmeirer H, Nicklaus J, 1999. The impact of peer and principal collaborative supervision on teacher's trust, commitment, desire for collaboration, and efficiency. *Journal of Curriculum and Supervision*, 144, 351-378.

- Eraslan A, 2009. Prospective mathematics teachers' opinions on 'teaching practice'. Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education. 31, 207-221.
- Gebhard G, 1990. Models of Supervision: choices. In Second Language Teacher Education. Edited by Richards, J & Nunan, D.
- Glanz J, Shulman V, Sullivan S, 2005. Impact of Instructional Supervision on Student Achievement: Can We Make the Connection? Paper presented at the Council of Instructional Supervision COPIS annual conference, Athens, Georgia.
- Glatthorn A, 1997. Differentiated supervision. Alexandria, VA: Association for Supervision and Curriculum Development.
- Glickman C, Gordon S, Ross-Gordon J, 2013. Supervision and instructional leadership: A developmental approach 9th ed.. New York: Pearson.
- Goldhammer R, Anderson R, Krajewski R, 1993. Clinical supervision: Special methods for the supervision of teachers 3rd ed.. Stout: Rinehart and Winston Inc.
- Holland P, Adams P, 2002. Through the horns of dilemma between instructional supervision and the summative evaluation of teaching. Journal of Educational Leadership, 5 3, 227-247.
- Hunzicker J, 2011. Effective professional development for teachers: A checklist. Professional Development in Education, 372, 177-179.
- Neal S, Dawn F, 1995. Collaborative Professional Development in a Primary School: a case study, Journal of In-Service Education, 21:1, 15-36, DOI: 10.1080/0305763950210103
- Nolan J, Hoover L, 2004. Teacher supervision and evaluation: theory into practice. Danver, MA:Wiley/Jossey-Bass Education.
- Oduro G, 2008. Increased enrolment does not mean quality education. Ghana News Agency. Available from <http://news.myjoyonline.com/education/200809/20151.asp>.
- Okafor P, 2012. Leadership in instructional supervision: Aspect of clinical supervision in the education system. <http://www.patrickokafor.com/files/ClinicalSupervision.pdf>. Accessed 14 April 2020
- Opare J, 1999. Academic achievement in private and public schools: Management makes the difference. Journal of Educational Management, 21: 12-22.
- Pajak E, 2010. The history and future of instructional supervision in the United States.
- Paker T, 2008. Problems of student teachers regarding the feedback of university supervisors and mentors during teaching practice]. Pamukkale Üniversitesi, 23, 132-139.
- Ralph E, 1998. Developing practitioners: A handbook of contextual supervision. Stillwater, OK: New Forums Press.
- Richardson R, 2011. An overview of supervisory; Institute of Welfare. <https://www.researchgate.net/publication/275542607> Accessed 3 April 2020.

- Sarfo F, Cudjoe B, 2016. Supervisors' Knowledge and Use of Clinical Supervision to Promote Teacher Performance in basic schools; *International Journal of Education and Research* Vol. 4 No. 1 January 2016
- Sergiovani T, Starratt R, 2002. *Supervision a redefinition*. 7th ed. Boston: Mc Graw Hill. UPM Library LB2806.4 S484 2002 3.
- Veloo A, Macdalena M, Komuji A, Khalid R, 2013. The effects of clinical supervision on the teaching performance of secondary school teachers, presented at the 3rd World Conference on Learning, Teaching and Educational Leadership; School of Education and Modern Languages, Universiti Utara Malaysia, 6010 Sintok, Malaysia Published by Elsevier Ltd. <http://www.sciencedirect.com>. Accessed 9 May 2020.

Appendices

A. Questionnaire

Question 1: Which of the following principles guides you when carrying out an instructional supervision exercise? (You can tick more than one)

Principle of supervision approach	Tick Here
a) Every cycle of supervision goes through a series of systematic steps, the end of which informs the next cycle	[]
b) Focus on all the components of the school structure as influencing a teacher's instructional behaviour	[]
c) Guidance and support given depends on teacher's developmental level of teaching in terms of knowledge, skill, and ability	[]
d) Joint problem solving aimed at improvement of a teachers instructional strategies	[]
e) Organizational and personal factors adjusted in support of the expected change and improvements toward the benchmarks evaluated in each supervisory visit	[]
f) Pay attention to the teachers readiness in terms of the degree of self-assurance, willingness, motivation, and enthusiasm to engage in the teaching and supervision	[]
g) Recognizing that the teachers or groups are at different levels of skill developmental	[]
h) Small group of teachers observe each other's classes and give feedback in a mutually respectful process	[]
i) Supervision approaches are varied between directive, collaborative, and nondirective assistance depending on whether the teacher is a novice, moderate or expert in skills	[]
j) Supervisor mentors the teacher through a series of instructional observations focusing on teaching outcomes instead of teaching methods	[]
k) Supervisory feedback to the teacher is only given if there were any immediate concerns	[]
l) Teacher independently works on improvement benchmarks cooperatively set with the supervisor	[]
m) The instructional supervisor takes a more passive of listening, reflecting, clarifying, encouraging, and problem solving	[]
n) Teacher independently develops and carries out plans for his/her professional growth on an areas of concern with the instructional supervisor as a resource and mentor	[]
o) There is reflection and analysis of effective and ineffective instructional strategy through actual classroom observation	[]

Question 2: Instructional supervision is a process. Kindly list the steps you have observed as being followed in the instructional supervision exercise that you have been engaging in for the last two years.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

Question 3: Which of the following activities would you say do take place in the instructional supervision exercise you have engaged in? (Tick appropriately)

Activities in instructional supervision	Done	Not Done
a) Drawing and reviewing the instructional supervision schedules for the day	<input type="checkbox"/>	<input type="checkbox"/>
b) Clarifying/informing about the purposes and foci of the instructional supervision	<input type="checkbox"/>	<input type="checkbox"/>
c) Clarifying the lesson plan in terms of purpose content teaching strategies and learning outcomes for the lesson to be observed	<input type="checkbox"/>	<input type="checkbox"/>
d) Reviewing of the classroom observation instruments and ratings	<input type="checkbox"/>	<input type="checkbox"/>
e) Supervisors physical presence in classroom as teacher teach	<input type="checkbox"/>	<input type="checkbox"/>
f) Teacher present the lesson uninterrupted	<input type="checkbox"/>	<input type="checkbox"/>
g) Observation strictly done on the areas specified in the data collection instruments	<input type="checkbox"/>	<input type="checkbox"/>
h) Review and consolidation of all the data collected from classroom observation	<input type="checkbox"/>	<input type="checkbox"/>
i) Grading/rating the teacher's performance for the lesson observed, and recommendation for improvement	<input type="checkbox"/>	<input type="checkbox"/>
j) Draws a plan on how the post-observation conference begin and ends, what to discuss in the gathering and with individual teachers	<input type="checkbox"/>	<input type="checkbox"/>
k) Small talk to put people at ease and be receptive	<input type="checkbox"/>	<input type="checkbox"/>
l) Discussion/analysis, critiques and clarification on teachers instructional behavior patterns, events and incidences that occurred in the classroom	<input type="checkbox"/>	<input type="checkbox"/>
m) Communicate the rating of the teacher performance in the classroom	<input type="checkbox"/>	<input type="checkbox"/>
n) Drawing a tentatively plan for instructional improvement	<input type="checkbox"/>	<input type="checkbox"/>
o) Self-reflection/analyzing self and other's behaviour, performance and response to the instructional supervision	<input type="checkbox"/>	<input type="checkbox"/>
p) Ensuring and taking remedial actions towards improving future instructional supervision endeavors	<input type="checkbox"/>	<input type="checkbox"/>
q) Scrutinizing how well the cycle went, what worked well and what did not	<input type="checkbox"/>	<input type="checkbox"/>

B. Interview schedule

This interview schedule is made up of three questions. The interviewer is free to ask any other question that would help to shed more light on the key issues of the research study.

Question 1: From your experiences, which characteristics would you give as key in guiding the interaction between the teachers and external supervisors during instruction supervision at school level?

Question 2: What steps or stages would you say are commonly followed in the process of instructional supervision at school level when being carried out by external supervisors?

Question 3: What are the supervisory activities carried out at each of the above mentioned stages?

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