

1 The Moderating Role of Teacher Self-Efficacy in Technology on
2 the Relationship between Transformational Leadership Style and
3 ICT Integration in Teaching and Learning

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8 **Abstract**

9 In spite of the trainings mounted by the government and other stakeholders in Education to
10 capacity build the teachers in using technology the uptake has been low. Previous studies
11 report that the integration of Information, Communication and Technology (ICT) into the
12 curriculum remains problematic in the school context. Some of the problems encountered in
13 the process of integrating ICT into the curriculum are school leaders' perceptions of ICT. It is
14 against this backdrop that the present study sought to investigate how transformational
15 leadership style predicts ICT integration in teaching and learning in public primary schools in
16 Nairobi County and the moderating role of teachers' self-efficacy on technology and school
17 environment respectively. The target population for this study comprised of 6150 teachers
18 drawn from public primary schools in Nairobi County. The study was conducted in a sample
19 of the public primary schools in the eleven sub-counties of Nairobi County namely; Embakasi,
20 Makadara, Kamukunji, Starehe, Njiru, Kasarani, Westlands, Langata, Kibra, Mathare and
21 Dagoretti. Simple random sampling from the target was employed in the study. Teachers
22 responded to a structured questionnaire while the head teachers had an in-depth interview.

23

24 **Index terms**— teacher self-efficacy, transformational leadership style, ICT integration in teaching and
25 learning.

26 **1 Introduction**

27 The demand for a well-educated workforce has driven many countries to reengineer their education systems. An
28 education system has to be suited to the demands of the technological age so that a competitive edge can be
29 maintained. Accordingly, the digital age has not simply changed the nature of resources and information; it
30 has transformed several basic social and economic enterprises. Contemporary society—the settings where we live,
31 work, and learn—has likewise changed dramatically. Both the amount of information and access to it has grown
32 exponentially; a significant potential for using varied resources in numerous ways for instruction and learning has
33 emerged (Hill, 2011).

34 The effective use of the wide range of facilities offered by ICT opens up unprecedented opportunities for
35 invigorating learning and teaching in our schools and improving pupils' attainment in coursework across the
36 whole curriculum. Indeed, the thinking on the nature of the curriculum itself is likely to be challenged as the
37 use of ICT becomes more effective and widespread. The reformed curriculum that Kenya is experiencing at the
38 moment is edged on the nurturing every child's potential. Central to the competencies that it addresses is the
39 digital literacy that is entrenched in every learning area ??Basic Curriculum Framework, 2016). Besides, the
40 government's initiative of deploying digital devices to all standard one pupils in Primary schools in Kenya is
41 another indicator of how fast ICT is invigorating teaching and learning process in Kenya.

3 B) TEACHERS SELF EFFICACY IN TECHNOLOGY

42 Both the school leadership and teachers are at the centre of this teaching and learning process. School
43 leadership plays a key role in improving school's outcomes by influencing the motivation and capacities of teachers
44 as well as the school environment and environment (Bush, 2015). The head teacher must employ inclusive kind of
45 leadership where they will involve other people as a team. This team gets a deliberate opportunity to contribute
46 to the vision, culture and climate of the school and thus the head teacher has a duty to create the opportunities
47 to make this happen and teachers partly determine the leadership styles of the head teacher (Mutula, 2016). As
48 a leader, the head teacher has the power to influence job satisfaction among the teachers under them. Leadership
49 styles or traits are the characteristic way in which a leader uses power, makes decision, and interacts with others.
50 The transformational headteachers has been particularly found to favor innovative teaching and learning practices
51 ??(Kouzes, 2009;Bush, 2015; ??unwar, 2011; ??arah, 2011).

52 Like headteachers, teachers are also pertinent in the successful integration of ICT into teaching and learning.
53 With the advent of technology in teaching and learning, it has become imperative that the teachers embrace the
54 use of ICT to boost their efficacy. With the dynamism in technology, it is possible that teachers face difficulties
55 in adopting technology in their work. Previous studies have identified several reasons for this underutilization of
56 technology including but not limited to lack of resources, lack of training, philosophical beliefs about technology,
57 and lack of time to experiment with technology tools (Compeau & Higgins, 1995;Kellenberger & Hendricks,
58 2013;Littrell, et al., 2015;Teo, 2009;Wang, Ertmer, & Newby, 2014). Further, many researchers attribute
59 underutilized technology to teachers' lack of self-efficacy in incorporating such resources into their classrooms
60 (Kellenberger, & Hendricks, 2013). Against this background, we set out to investigate the association among the
61 transformational leadership style, teacher self-efficacy in technology and ICT integration in teaching and learning.

62 2 a) Transformational Leadership Style and ICT Integration in 63 Teaching and Learning

64 Literature reveals that in its current form, the full range leadership has shown leaders as having five
65 transformational leadership attributes, three transactional leadership attributes, and one non transactional
66 laissez-faire leadership. Transformational leadership is a model of leadership where the leaders inspire members
67 to go beyond their task requirements. Burns (1978) defined a transforming leader as one who: '(1) raises the
68 followers' level of consciousness about the importance and value of designated outcomes and ways of reaching
69 them; (2) gets the followers to transcend their own self-interest for the sake of the team; (3) raises the followers'
70 level of need on Maslow's (1954) hierarchy of needs, from lower-level concerns for safety and security to higher
71 level needs for achievement and self-actualization' ??Bass, 2008). A transformational leader on the other hand is
72 capable of delivering performance beyond expectations ??Bass, 1985) by (1) raising followers level of awareness
73 of the importance of achieving valued outcomes and the strategies for reaching them, (2) encouraging followers to
74 transcend their self-interest for the sake of the team, organization, or a larger cause and (3) developing associates'
75 needs to higher levels in such areas as achievement, autonomy, and affiliation, which can be both work related
76 or outside work related.

77 In the school context, transformational leadership (Kouzes, 2009) refers to leadership skills in those head
78 teachers who can pioneer the school to a new level at the hinge of school development. Of all leadership styles,
79 transformational leadership is found to have the strongest positive impact on school environment. This is because
80 the head teacher's motive is to empower the teachers as partners and both the head teacher and teachers are
81 guided by a shared vision. Staff members depend on one another and work together as a team. While technology
82 infrastructure is important, ICT leadership is even more necessary for effective ICT implementation. Head
83 teachers are aware of the fact that creating a positive and supportive climate is one of the important aspects of
84 their responsibilities. Moreover, they believe that the climate among and between teachers is one of the factors
85 with which to measure school success (National Association of Secondary School Head teachers (NASSP) 2001:
86 51-52). Therefore, it can be suggested that head teachers should embrace a transformational style of leadership.
87 It is assumed that this style of leadership would be effective in creating a goal-oriented atmosphere in the school.

88 3 b) Teachers Self Efficacy in Technology

89 Holden and Rada (2011) suggested that by increasing teachers' technology self-efficacy, they might directly
90 increase their acceptance of technology and also indirectly increase their usage of technology. In which case
91 therefore there will be more teachers enrolled in online courses since they will be confident in using ICTs.
92 Furthermore, Brown, Holcomb and Lima (2010) asserted that technology self-efficacy has come to play a crucial
93 role in the preparation and implementation of educators who can successfully use educational technology to
94 enhance learner learning. How would teachers increase technology efficacy in order to adopt ICT in Teaching
95 and learning? In her study, ??arah (2011), gathered that professional development opportunities are critical to
96 teachers adopting use of technology. This entails more targeted and specialized teacher training on instructional
97 technology and increased knowledge of and access to instructional technology tools and resources. Further
98 increased teacher collaboration with a focus on instructional technology and creating opportunities for teacher
99 observations and demonstrations would enhance adoption of technology. In my opinion, teachers prefer to work
100 together as teams. They gain a lot in sharing their experiences as well as challenges that they face as they execute
101 their duties. This aspect of sharing is backed Farah's (2011) research.

102 Through increased teacher collaboration with a focus on instructional technology, teachers would have the
103 opportunity to share, discuss, and explore ways to integrate instructional technology in their instructional
104 practice. This agrees with Duncan's (2010) view where he identified the need to connect teachers and leverage
105 technology to enable us to build the capacity of teachers. He also discussed the benefit of online learning
106 communities which would create opportunities for teachers to collaborate with peers, as well as reach out to
107 experts all over the world. Elimika course is one such platform offered by the Kenya Institute of Curriculum
108 development (KICD) where teachers can interact.

109 **4 c) ICT Integration in Teaching and Learning**

110 Kenya has realized the importance of embracing technology in learning and has made tremendous steps towards
111 integrating it in education. The government of Kenya is devoted to the utilization of ICT which includes digital
112 information technologies, and other resources to enhance access to learning for all Kenyans as indicated in its
113 strategic plan ??GOK, 2016). The government has developed a National policy that led to the development of
114 National ICT strategy for education and training (2016). This strategy outlines the implementation of use of ICT
115 in teaching and learning process. It further reinforces the government desire to use ICT to facilitate education.

116 Consequently, there has been continuous deployment of ICT infrastructure to schools and learning institutions.
117 Some of the initiatives along this line include the NEPAD e-schools (2015); the e-schools initiative; the Multi-
118 media lab project (TELEVIC); the ESP-ICT Computer for schools project (2010 -2012); the Accelerating 21 st
119 Century Education (ACE) project (2010-2012); Tafakari Project in TTCs; the Badiliko Project (British Council)
120 and the Holistic Model project (2011-2012). The most recent of these initiatives is the Digital Literacy program
121 (DLP) where learning devices have been deployed in all the primary schools in Kenya for the standard one pupils.
122 This deployment is coordinated by ICT authority and is one of the flagship projects of the Government of Kenya.

123 Further, to provide coordination and harmonization of initiatives in education, the State Department of
124 Education established ICT4E unit and Team. This has provided continued guidance on publicprivate partnerships
125 to mobilize resources for ICT in education. Besides, the government through Kenya Institute of Curriculum
126 development has developed digital content for Primary and Secondary Schools for use by the learners in the ICT
127 integration in Education. Accordingly, there is a wide range of ICT initiatives and projects ongoing in Kenya
128 focused on e-infrastructure with the aim of boosting the adoption of ICT in public primary schools not only
129 in Nairobi County, but across the country. Key among these include the Digital Learning Programme (DLP)
130 initiated by the Government of Kenya in 2013. The programme targets learners in all public primary schools and
131 is aimed at integrating the use of digital technologies in learning. Under the programme, 75,000 public primary
132 school teachers have been trained as at October 2018 in readiness for the project implementation (GoK, 2019).

133 However, given the milestones achieved so far in ICT integration in education in Kenya, and also the efforts
134 put in place to ensure that technology is in use in the Kenyan schools, teachers have been slow in adopting
135 use of ICTs in teaching and learning indicated by low uptake levels (MOE, 2012). The British Educational
136 Communications and Technology Agency (2014) reported that only few teachers succeed in integrating ICT into
137 subject teaching in a fruitful and constructive way that can promote learners' conceptual understandings and can
138 stimulate higher-level thinking and reasoning. The report further states that in most of the cases, teachers just
139 use technology to do what they have always done, although in fact they often claim to have changed their teaching
140 practice. Further, a number of teachers report that they do not feel comfortable with the ICT integration in
141 subject teaching, since their role was predetermined and designed by educational authorities and teachers feel
142 that they face a lack of professional autonomy (Olson, 2010). Although the government has provided a national
143 roadmap ICT policy, financial plan for ICT use in schools that requires its relevant extraction and implementation
144 by key school leaders including the deployment of digital devices in all the Primary schools in Kenya through
145 DLP. Despite these road maps developed by the government to implement ICT-based curriculum and instruction
146 in schools, the situation in many schools in Kenya is that many of these schools are not effectively implementing
147 ICT in curriculum and management as intended.

148 Previous studies (Keiyoro, 2011;Manduku et al., 2012; ??ing, 2013) report that the ICT integration into
149 the curriculum remains problematic in the school context. Some of the problems encountered in the process
150 of integrating ICT into the curriculum are school leaders' perceptions of ICT and teacher competency.
151 Further, extant studies with respect to ICT integration in teaching and learning have been narrow in their
152 conceptualization, focusing on among others, factors influencing effective use of ICT in teaching and learning
153 (Keiyoro, 2011); Adoption and use of ICT in enhancing management of public secondary schools (Manduku et
154 al., 2012); Constrains in the use of ICT in teaching and learning (Gikonyo, 2012); and the relationship between
155 head teachers' access to ICT and school performance (Mutula, 2016).

156 It is against this backdrop that the present study sought to establish the extent to which transformational
157 leadership style influences ICT integration in teaching and learning in public primary schools; to establish the
158 extent to which teacher efficacy in technology influences integration ICT in teaching and learning in public primary
159 schools; and to examine the moderating influence of teacher self-efficacy in technology on the relationship between
160 transformational leadership style and integration of in teaching and learning in public primary schools.

7 B) TRANSFORMATIONAL LEADERSHIP STYLE AND ICT INTEGRATION

161 5 II.

162 6 Literature Review a) ICT Integration in Teaching and Learn- 163 ing

164 For technology to be seamlessly integrated in teaching and learning, it is important that teachers are well versed
165 with technology to the extent that they have confidence to use it in the classroom. Holden and Rada (2011)
166 suggested that by increasing teachers' technology self-efficacy, they might directly increase their acceptance of
167 technology and also indirectly increase their usage of technology. Furthermore, Brown, Holcomb and Lima (2010)
168 asserted that technology self-efficacy has come to play a crucial role in the preparation and implementation of
169 educators who can successfully use educational technology to enhance learner learning. How would teachers
170 increase technology efficacy in order to adopt ICT in Teaching and learning? Exposure to technology as well as
171 interest in using it would help boost the teachers' self-efficacy in technology. Constant use of the same would give
172 them the confidence they require in its usage. In her study, ??arah (2011), gathered that professional development
173 opportunities, more targeted and specialized teacher training on instructional technology and increased knowledge
174 of and access to instructional technology tools and resources are key to teachers adopting use of technology.
175 She further noted that increased teacher collaboration with a focus on instructional technology and creating
176 opportunities for teacher observations and demonstrations.

177 Through increased teacher collaboration with a focus on instructional technology, teachers would have the
178 opportunity to share, discuss, and explore ways to integrate instructional technology in their instructional
179 practice. This agrees with Duncan's (2010) view where he identified the need to connect teachers and leverage
180 technology to enable us to build the capacity of teachers. He also discussed the benefit of online learning
181 communities which would create opportunities for teachers to collaborate with peers, as well as reach out to
182 experts all over the world. Because teachers are in the trenches teaching learners, they can easily relate to
183 other teachers and provide significant support to their colleagues to help promote effective uses of instructional
184 technology. These ideas are consistent with one of the goals presented in Georgia's technology plan, which
185 states the need to increase teachers' proficiency to use technology effectively in order to enhance learner learning
(Georgia Department of Education, 2013).

187 Different categories have been used by researchers and educators to classify factors that influence teacher use of
188 ICT in teaching. Sherr and Gibson (2012) claims that technological, individual, organizational and institutional
189 factors should be considered when examining ICT adoption and integration. Rogers identified five technological
190 characteristics or attributes that influence the decision to adopt an innovation namely Relative Advantage,
191 Compatibility, Simplicity, Triability and Observability (Rogers, 2013). Stockdill and Morehouse (2012) also
192 identified user characteristics, content characteristics, technological considerations, and organizational capacity
193 as factors influencing ICT adoption and integration into teaching. Balanskat, Blamire & Kefalla (2012) identified
194 the factors as teacher-level, schoollevel and system-level. Neyland (2011), identified factors such as institutional
195 support, as well as micro factors such as teacher capability influencing the use of online learning in high schools
196 in Sidney.

197 A study done by Lau and Sim, (2008) in Malaysia on "exploring the extent of ICT adoption among secondary
198 school teachers in Malaysia" showed that despite the apparent benefits of the use of ICT for educational purpose,
199 the potential of learning is deprived as many teachers are still not fully ICT literate and do not use it in their
200 teaching. Studies on teacher's readiness for ICT suggest that there is still a long way to go before schools in
201 developing countries are able to take full advantage of the opportunities provided by

202 7 b) Transformational Leadership Style and ICT integration

203 Success of any institution is pegged on the leadership. Continuous success and prosperity of any institution is
204 directed by the ever-changing situations that impact on leadership. School leaders should take cognizance of
205 this aspect. In the world that we live in today, school leaders' roles have changed from practicing teachers with
206 added responsibilities to fulltime professional managers of human, financial and other resources accountable for
207 their results (Bolam, McMahon, Pocklington & Weindling 2010). This has meant that more and more tasks have
208 been added to the job description: instructional leadership, staff evaluation, budget management, performance
209 assessment, accountability, and community relations, to name some of the most prominent ones. In light of the
210 foregoing, this section reviews the concept of transformational leadership style, hailed as the most effective in
211 school management in general and ICT integration in particular (Bush, 2015; ??unwar, 2011; ??arah, 2011).

212 Transformational leaders are proactive, raise awareness levels of followers and help the followers to achieve
213 high performance outcomes. This has been affirmed by ??ass, 1990. Transformational leaders pay particular
214 attention to each individual's needs for achievement and growth. Hamidifar (2009) found that employees are
215 more satisfied with transformational leadership than any other style. He also revealed that this type of leadership
216 was not being exercised by the managers. The study concluded that transformational leadership led to better
217 satisfied employees. Nguni, Sleegers, and Denessen (2016) also studied the effects of transformational leadership
218 on teachers' job satisfaction, organizational commitment, and organizational citizenship in schools in Tanzania.
219 They observed that the leadership style was distinguished by the different ways' leaders motivate their followers
220 and appeal to the emotions and values of their followers. The teachers rated their head teachers particularly high

221 on the transformational leadership traits of charismatic leadership, individualized consideration, and intellectual
222 stimulation.

223 A study by Nthuni (2012) on leadership style factors that influence motivation of pre-school teachers in
224 public pre-schools in Embu North District, revealed that there was need to adopt a transformational leadership
225 style in order to enhance motivation of preschool teachers in public pre-schools and improve their working
226 environment by involving them in decision making and in policy formulation in their schools. Kibue (2008) study
227 on transformational leadership style on public secondary schools in Kirinyaga County revealed that majority of
228 head teachers and teachers did not understand nor use the transformational leadership style in schools. This
229 style is still a new concept to many. The researcher concluded that there was need for teachers to be trained
230 and properly inducted on leadership in order to properly manage both human and material resources. Against
231 this backdrop, we hypothesized that transformational leadership style does not have a significant influence on
232 the ICT integration in teaching and learning (H 01).

233 **8 c) Teacher Efficacy in Technology and ICT Integration**

234 With the advent of technology in teaching and learning, it is imperative that the teachers embrace the use of
235 ??CT In a qualitative multiple case-study research on teachers' competence and confidence level regarding the
236 use of ICT in teaching practiced conducted in five European countries, Peralta and Costa (2014) found that
237 technical competence influenced Italian teacher's use of ICT in teaching. However, the teachers cited pedagogical
238 and didactic competences as significant factors if effective and efficient educational interventions are likely to be
239 implemented. In Syria, for example, teachers' lack of technological competences has been cited as the main barrier
240 (Albirini, 2014). In Australian research, Newhouse (2012) found that many teachers lacked the knowledge and
241 skills to use computers and were not enthusiastic about the changes and integration of supplementary learning
242 associated with bringing computers into their teaching practices.

243 A study by Ayere et al, (??010) on E-learning in secondary schools in Kenya reported that a number of teachers
244 in secondary schools had not received any training in ICT use during their formative years at teacher training
245 institutions before joining the profession. 55% of the sampled teachers stated that they did not receive any ICT
246 training at all. However, 51% of the teachers had taken self-initiative to undertake ICT training during the
247 last three years they had been employed. A report by the Ministry of Higher education, Science and Technology
248 (GOK, 2010) on secondary school teachers' adoption and use of ICT indicated that the number of teachers skilled
249 in ICT in secondary schools was low. The study revealed that out of the number available, few had ICT training
250 effective in adoption and use of the technology in the classroom. Out of 232 teachers in the sample, majority
251 (57%) were reported to have trained at certificate level on basic computer skills, 73% were reported to have
252 acquired ICT training through in-service courses and 43% were trained by private computer college.

253 Similarly, a study by Mingaine (2013) that carried out in Meru County involved a sample of 315 respondents
254 and investigated the skill challenges in ICT integration in public secondary schools. The study which employed
255 a descriptive survey design found that, there is limited supply of qualified ICT teachers and that majority of
256 secondary school teachers in Meru County were not competent to facilitate use of ICT in schools. It also concluded
257 that the level of training of majority of the teachers is far from being satisfactory due to lack of exposure during
258 formative training in initial teacher training institutions. A study by Ayere et al (??010) compared e-learning in
259 NEPAD and non-NEPAD schools that were offering computer studies and found that teachers in NEPAD schools
260 integrated ICT in the learning in all subjects, whereas little or no integration took place in the non-NEPAD
261 schools. This finding could be explained by the fact that more teachers from NEPAD schools were computer
262 literate (60%) as compared to their non-NEPAD counterparts (31%). At the same time, NEPAD schools had
263 more ICT graduate teachers (53%) than the non-NEPAD schools (33%) (Ayere et al 2010). These figures cannot
264 be taken to be representative of the situation in the entire country, though, because the study included just a
265 few selected schools all of which were already utilizing computers. There is a need to establish the situation in
266 other parts of the country.

267 Teachers' motivation towards their efficacy is hedged on their self-worth which is directly linked to their
268 perception on who they are. The theory on Selfworth asserts that a person's ability to achieve is directly linked
269 to their perceptions of themselves. Martin Covington, the pioneer in the psychology field of selfworth and self-
270 efficacy, states that most people will go to extraordinary lengths to "protect their sense of worth or self-value,"
271 even if it infringes on the ultimate outcome of their achievement ??Covington, 1984, p. 4). Recent work on teacher
272 motivation within the framework of expectancy-value theory (Richardson & Watt, 2006; Watt & Richardson, 2007)
273 provides evidence for links between teachers' motivation and their engagement, commitment and persistence in
274 teaching and their inclination to become involved in professional development. There is considerable agreement
275 that teachers' motivation and scepticism about affecting learners is associated with enthusiasm, job commitment,
276 and instructional behaviour (Tschanen-Moran & Woolfolk Hoy, 2001). Furthermore, research has identified a
277 link between teacher efficacy and learner efficacy and achievement as well (Feldhauser et al., 1988; ??oss & Cousins,
278 1993).

279 A growing number of studies have been conducted on teachers' confidence in their use of computers, either for
280 personal work or in their teaching practice. Several studies (Lynch, 2013; Macmillan, Timmons and Liu, 2011;
281 Sandholtz, Ringstaff and Dwyer, 2012) reported that teachers were reluctant to reveal their level of computer
282 knowledge to learners and were unwilling to use computers in regular teaching practice until they felt comfortable

10 METHODOLOGY

283 and competent in using the technology. Teachers with more computer experience had greater confidence in their
284 ability to use computers effectively (Galloway, 2013;Nash and Moroz, 2015).

285 Against this backdrop, we hypothesized that state that teacher self-efficacy in technology does not have a
286 significant influence on ICT integration in teaching and learning (H 02); and that teacher self-efficacy in technology
287 does not have a significant moderating influence on the relationship between transformational leadership style and
288 ICT integration in teaching and learning (H 03). Accordingly, the hypothesized relationships are conceptualized
289 and as illustrated in Appendix I.

290 9 III.

291 10 Methodology

292 This study was approached from a pragmatism point of view, which was deemed best in underpinning the present
293 study as it allowed for flexibility in approach including the collection of different data types, use of various data
294 collection methods as well as data analysis techniques. The philosophy is further justified as the study involves
295 ICT which is dynamic, involvements of different persons with divergent views and with varied leadership styles.

296 The study also adopted a mix of cross-sectional survey, correlational and mixed methods design. The study
297 used a cross-sectional survey design since the object of the study was to document the situation as it is at the
298 present time. The survey involved field visits to sampled schools so as to get first hand observation data and
299 views from respondents. The study also employed a correlational study design which is a quantitative method
300 of research in which there are two or more quantitative variables from the same group of participants, and one
301 is trying to determine if there is a relationship (or covariation) between the two variables (that is, a similarity
302 in pattern of scores between the two variables, not a difference between their means). Qualitative methods,
303 particularly content analysis was also employed in the study as interview schedules were used that provided
304 qualitative data hence mixed methods design.

305 The target population for this study comprised of public primary schools' teachers drawn from Nairobi County.
306 Nairobi City County was selected as a suitable site for the study because it is a cosmopolitan area with pupils
307 and teachers drawn from different social cultural backgrounds. The study targeted teachers from the 205 public
308 primary schools in Nairobi County (NCEO, 2016). Respondents were drawn from the population of 205 head
309 teachers and 6150 teachers in Nairobi county. Only head teachers and teachers were reached owing to the nature
310 of the study objectives which only required their input. While head teachers were crucial in examining the head
311 teachers' leadership roles in the implementation of ICT in primary school administration, teacher responses were
312 required to determine the moderating role of teacher self-efficacy on the ICT integration in teaching and learning.

313 The study was conducted in a sample of the public primary schools in the eleven sub-counties of Nairobi County
314 namely; Embakasi, Makadara, Kamukunji, Starehe, Njiru, Kasarani, Westlands, Langata, Mathare, Kibra and
315 Dagoretti. The sample population was 205 head teachers from 205 Public Primary Schools in Nairobi County
316 with 6150 teachers. Owing to the anticipated large number of respondents that included 6150 teachers and 205
317 head teachers, the study employed a combination of two formulae. For teachers the study used the Fisher et al.
318 ??1983) formula for determining sample sizes in large populations; while for head teachers, the study referred to
319 Mugenda and Mugenda (2003) who proposes a 30% proportion in extremely small population sizes and 10% for
320 larger populations. The 10% proportion will be used in the present study giving a sample of 21 head teachers.
321 The Fisher et al. ??1983) formula is as shown below:
$$n = \frac{N}{1 + (N * e^2)}$$

322 Where; N= population size e= Tolerance at desired level of confidence, take 0.05 at 95% confidence level n=
323 sample size. For teachers, the sample size will be arrived at as follows: $n=6150/(1+(6150*0.05*0.05))$ n=375.57
324 As such, the study was to reach a total of 376 teachers A combination of cluster sampling and random sampling
325 procedures was employed in the study. Whereas the sub counties formed the clusters random sampling was used
326 to reach the head teachers from 21 primary schools in Nairobi County. The 11 sub-counties formed the cluster
327 from where the sample size (376) of teachers were proportionately drawn.

328 The instruments used for data collection were structured questionnaires for teachers while the head teachers
329 were taken through an in-depth interview using an interview guide. An observation checklist was further used to
330 assess resources used by the teacher for ICT integration in teaching and learning. Different sets of questionnaires
331 were developed for the teachers.

332 Both linear and moderation regression analyses were performed to assess the strength and direction of the
333 relationships between the specified variables as well as the statistical significance. To this end, various statistics
334 were extracted and interpreted with respect to the various models. Linear multiple regression analysis was
335 employed in testing null hypothesis 1 (H 01) as illustrated in equation I and hypothesis 2 (H 02) as illustrated
336 in equation II. Moderation regression was on the other hand employed in testing null hypotheses 3 (H 03) as
337 illustrated in equation III.

338 **11 Results**

339 **12 a) Transformational Leadership Style and ICT Integration:**
340 **Model Summary**

341 The statistical model $Y = \beta_0 + \beta_1 X_1 + \epsilon$ where: $Y = \text{ICT Integration}$, $\beta_0 = \text{constant}$, $\beta_1 = \text{Coefficient}$
342 of X_1 , $X_1 = \text{Transformational leadership}$, $\epsilon = \text{Error term}$ was used to establish the extent to which
343 transformational leadership style influences ICT integration in teaching and learning in public primary schools.
344 Accordingly, H_0 stating that transformational leadership style does not have a significant influence on
345 the ICT integration in teaching and learning was tested. From Appendix II, there was correlation between
346 transformational leadership and ICT integration indicated by R which was 0.207. The value of $R^2 = 0.043$
347 meaning that transformational leadership style explains the variance of ICT integration by 4.3% the variance of
348 ICT integration. From the ANOVA results in Appendix II, the model was found to be statistically significant (F
349 $(1,293) = 13.124$, $p\text{-value} < 0.001$) and implies that there was a goodness of fit of the model. This also indicates
350 that transformation leadership is a good predictor of ICT integration.

351 Given the statistical model $Y = \beta_0 + \beta_1 X_1 + \epsilon$, the beta coefficients of transformational leadership in Table
352 ??how that $\beta_1 = 0.207$, $t = 3.623$, $p\text{-value} < 0.001$ indicating that a unit improvement in the transformational
353 leadership style contributes to a 0.207 improvement in ICT integration. This further affirms that transformational
354 leadership style is significant predictor of ICT Integration in teaching and learning. The criterion for acceptance
355 or rejection was to reject if $p\text{-value}$ less than 0.05 otherwise H_0 is accepted. The results indicate a $p\text{-value} <$
356 0.001. This is also supported by a t -statistic of 3.623 which is larger than the critical t -statistic of 1.96. There
357 was, therefore, sufficient evidence to reject the null hypothesis, H_0 , that transformational leadership style does
358 not have a significant influence on the ICT integration in teaching and learning. The study therefore concluded
359 that transformational leadership style has a significant influence on the ICT integration in teaching and learning.

360 The finding is in agreement with Nguni, Sleegers, and Denessen (2016) who studied the effects of transfor-
361 mational leadership on teachers' job satisfaction, organizational commitment, and organizational citizenship in
362 schools in Tanzania. They observed that the leadership style was distinguished by the different ways' leaders
363 motivate their followers and appeal to the emotions and values of their followers. The finding is also consistent
364 with Nthuni (2012) in whose study on leadership style factors that influence motivation of pre-school teachers in
365 public pre-schools in Embu North District, revealed that there was need to adopt a transformational leadership
366 style in order to enhance motivation of pre-school teachers in public preschools and improve their working
367 environment by involving them in decision making and in policy formulation in their schools.

368 **13 b) Teacher Self-Efficacy in Technology and ICT Integration**

369 The statistical model $Y = \beta_0 + \beta_3 X_3 + \epsilon$ where: $Y = \text{ICT Integration}$, $\beta_0 = \text{constant}$, $\beta_3 = \text{Coefficient of } X$
370 3 , $X_3 = \text{Transformational leadership}$, $\epsilon = \text{Error term}$ was used to explore the extent to which teacher efficacy
371 in technology influences integration ICT in teaching and learning in public primary schools. Accordingly, H_0 ,
372 stating that teacher self-efficacy in technology does not have a significant influence on ICT integration in teaching
373 and learning was tested.

374 As seen in Appendix III, the value of $R^2 = 0.285$ meaning 28.5 per cent of the variation in ICT integration
375 can be explained by teacher self-efficacy in technology. The correlation is very high. Teacher self-efficacy in
376 technology influence ICT Integration in teaching and learning in Nairobi Primary schools. ICT Integration in
377 teaching and learning is a function of teachers' self-efficacy in technology. From the ANOVA results in Appendix
378 II, the model was found to be statistically significant ($F(1,284) = 112.69$, $p\text{-value} < 0.001$) and implies that there
379 was a goodness of fit of the model. This also indicates that teacher self-efficacy in technology is a good predictor
380 of ICT integration.

381 Given the statistical model $Y = \beta_0 + \beta_3 X_3 + \epsilon$, the beta coefficients of transformational leadership in Table
382 show that $\beta_3 = 0.534$, $t = 10.616$, $p\text{-value} < 0.001$ indicating that a unit improvement in the teacher self-efficacy
383 in technology contributes to a 0.534 improvement in ICT integration. H_0 , Teachers self-efficacy in technology
384 does not have a significant influence on ICT integration in teaching and learning, was tested using the results in
385 Appendix III. The criterion for acceptance or rejection was to reject if $p\text{-value}$ less than 0.05 otherwise H_0 is
386 accepted. The results indicate a $p\text{-value} < 0.001$. This is also supported by a t -statistic of 10.616 which is larger
387 than the critical t -statistic of 1.96. There was, therefore, sufficient evidence to reject the null hypothesis, H_0 ,
388 that teachers' self-efficacy in technology does not have a significant influence on ICT integration in teaching and
389 learning. The study therefore concluded that teachers' self-efficacy in technology does have a significant influence
390 on ICT integration in teaching and learning.

391 This consistent with Ayere et al (2010) whose study compared e-learning in NEPAD and non-NEPAD schools
392 that were offering computer studies and found that teachers in NEPAD schools integrated ICT in the learning in
393 all subjects, whereas little or no integration took place in the non-NEPAD schools. The finding was explained by
394 the fact that more teachers from NEPAD schools were computer literate (60%) as compared to their non-NEPAD
395 counterparts (31%).

396 14 c) Moderating Effect of Teacher Self-Efficacy

397 The statistical model $Y = \beta_0 + \beta_1 X_1 * X_3 + \epsilon$ where: Y = ICT Integration, β_0 = constant, β_1 = Coefficient
398 of X_1 , X_1 = Transformational leadership, X_3 = Teacher Self-Efficacy in Technology, ϵ = Error term was
399 used to examine the moderating influence of teachers' selfefficacy in technology on the relationship between
400 transformational leadership style and integration of in teaching and learning in public primary schools. The
401 model was also used to test H₀₃, which states that teacher self-efficacy in technology does not have a significant
402 moderating influence on the relationship between transformational leadership style and ICT integration in
403 teaching and learning. Both the transformational leadership style and teacher selfefficacy in technology were
404 confirmed to be significant predictors of ICT integration. This was the first important step before testing the
405 moderating effect (Aiken & West, 1991).

406 As shown in Appendix III, the model without the interaction term, teacher self-efficacy in technology, is
407 significant with $F(1, 283) = 14.311$, p -value < 0.001 . The model with the interaction term is also significant with
408 $F(2, 282) = 58.721$, p -value < 0.001 . From Appendix IV, we note that R Square change without the interaction
409 term = 0.048, p -value < 0.001 while with the interaction term R Square change = 0.294, p -value < 0.001 .
410 This indicates a significant moderation effect between transformation leadership style and teacher self-efficacy
411 in technology. Transformational leadership style alone contributes 4.8 per cent on the state of ICT integration.
412 When the moderating variable, teacher selfefficacy in technology, is introduced the contribution rises more than
413 six-fold to 29.4 per cent. H₀₃, teacher self-efficacy in technology does not have a significant moderating influence
414 on the relationship between transformational leadership style and ICT integration in teaching and learning, was
415 tested using the results in Appendix III.

416 The criterion for acceptance or rejection was to reject if p -value less than 0.05 otherwise H₀₄ is accepted.
417 The results indicate a significant increase in the R Square change from 0.048 to 0.294 at p -value < 0.001 . This
418 is also supported by the significant F-statistic with $F(1, 283) = 14.311$, p -value < 0.001 without the interacting
419 term and significant $F(2, 282) = 58.721$, p -value < 0.001 with the interacting term. The null hypothesis, H₀₄,
420 teachers' self-efficacy in technology does not have a significant moderating influence on the relationship between
421 transformational leadership style and ICT integration in teaching and learning was rejected. The study concluded
422 that teachers' selfefficacy in technology does have a significant moderating influence on the relationship between
423 transformational leadership style and ICT integration in teaching and learning.

424 The study concludes that transformational leadership style significantly and positively the ICT integration
425 in teaching and learning. This can be attributed to the supportive, accommodative and change-oriented role
426 played by head teachers across a majority of the schools reached, that inspires and motivates teachers to develop
427 themselves part of which including improving their grasp of the concept of ICT and its implication for and
428 application in teaching and learning. Head teachers were observed to practice the transformational leadership
429 style largely to a moderate extent. This is exhibited in a majority of the head teachers' ability to make people
430 they interact with feel proud, good and have complete faith in him or her. Head teachers were also found to
431 help others find meaning in their work, expresses with a few simple words what we could and should do and help
432 teachers develop themselves.

433 The study also concludes that teacher selfefficacy in technology has a significant influence on ICT integration
434 in teaching and learning. As expected, the more conversance, confidence and motivation a teacher exhibits in
435 the use of ICT in teaching and learning, the more inclined they are to integrating ICT in their teaching and
436 learning profession. A majority of the respondent teachers reached were found to exhibit only moderate levels
437 of self-efficacy in using technology in their teaching profession. This was manifested in the teachers' moderate
438 competences in selecting and using various media to support teaching and learning, in the evaluation of software
439 to support teaching and learning, ability to integrate technology across the curriculum as well as the moderate
440 capability to determine why, when, and how to use technology in education.

441 The study further concludes that teacher selfefficacy in technology has a significant moderating influence on
442 the relationship between transformational leadership style and ICT integration in teaching and learning. This
443 can be attributed to the ability of a wellversed teacher in the application of ICT in teaching, to leverage the
444 supportive and accommodative role of the head teacher to harness the available ICT infrastructure and integrate
445 the same in their teaching profession, as compared to a teacher with low self-efficacy in technology.

446 It is recommended based on the study findings and conclusions that school administrations take a keen review
447 of the leadership style given that transformational leadership style is seen to have a significant influence on ICT
448 integration in primary schools. The study recommends that head teachers adopt the transformational leadership
449 style and offer support, motivation and encouragement to their teacher geared towards enabling teachers train
450 and develop their teaching practice especially towards honing their skills in their application of ICT in teaching.

451 It was further established that teachers' selfefficacy in technology has a significant influence on ICT integration
452 in teaching and learning. As such, teacher self-efficacy in technology emerges as a very core plank in ICT
453 integration when juxtaposed with the school environment and transformational leadership. It is therefore
454 recommended that school administrations as well as teacher management under the Teachers Service Commission
455 develops and executes programs to reinforce teachers' efficacy in the adoption, use and innovation in technology.
456 The study further asserts based on the findings that the onus is squarely on teachers to develop their teaching
457 careers and practice through leveraging such avenues as training programmes and seminars with a view to improve

458 their knowledge, confidence, experience and therefore selfefficacy in the use of ICT and its integration in their
459 teaching practice.

460 It is further recommended that the policy governing teacher training, establishment, improvement, support
461 and maintenance of school environments be reinforced with a view to impart digital skills in trainee teachers,
462 invest in the right infrastructure and reinforce the right school environment. It is also recommended that the
463 Ministry of Education and the related co-actors take measures to improve the school environment, especially in
464 setting up the right infrastructure, and operative policy environment given that the school environment is seen
465 to exert a significant influence on ICT integration.

466 Policy makers and regulators are also urged, as informed by the study findings to formulate polices and
467 regulations that ensure that as technological innovations progress and advance rapidly, their application in the
468 education sector in general and in teaching and learning in particular is leveraged to the utmost benefit and
safety of the consumers of these innovative products and services, which includes learners and teachers.¹

Previous

studies have identified several reasons for this underutilized of technology including but not limited to lack of resources, lack of training, philosophical beliefs about technology, and lack of time to experiment with technology tools (Compeau & Higgins, 1995; Kellenberger & Hendricks, 2013; Littrell, et al., 2015; Teo, 2009; Wang, Ertmer, & Newby, 2014). Further, many researchers attribute underutilized technology to teachers' lack of self-efficacy in incorporating such resources into their classrooms (Kellenberger, & Hendricks, 2013). Previous studies have identified several factors that may contribute in teachers' decisions to integrate technology into their classrooms. Self-efficacy is one of those factors (Compeau & Higgins, 1995; Kellenberger & Hendricks; Littrell, et al., 2015; Teo, 2009; Wang, Ertmer, & Newby, 2014). Therefore, teachers' efficacy in digital technology becomes very crucial in the ICT integration in Teaching and learning.

Figure 1:

469

¹The Moderating Role of Teacher Self-Efficacy in Technology on the Relationship between Transformational Leadership Style and ICT Integration in Teaching and Learning

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